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ABSTRACT

This report presents results of a project to assess the adequacy of existing data sources on the supply of 21 allied health occupations in order to develop improved data collection strategies and improved procedures for estimation of manpower needs. Following an introduction, chapter 2 provides a discussion of the general phases of the project and makes general recommendations for procedures to improve supply estimates and to improve estimations of requirements for allied health personnel. Chapters 3 to 11 contain individual reports and recommendations for each of the 21 occupations within the nine occupational clusters in this study. For each occupation, the discussion includes an overview of the occupation, definition of the population within the occupation, a description and assessment of data sources, and recommendations for estimating the supply within each occupation, current requirements, and future requirements. Each chapter also contains a summary of findings of the interviews conducted with individuals knowledgeable of the cluster and personnel-to-population ratios for each occupation for which data were available. (YLB)

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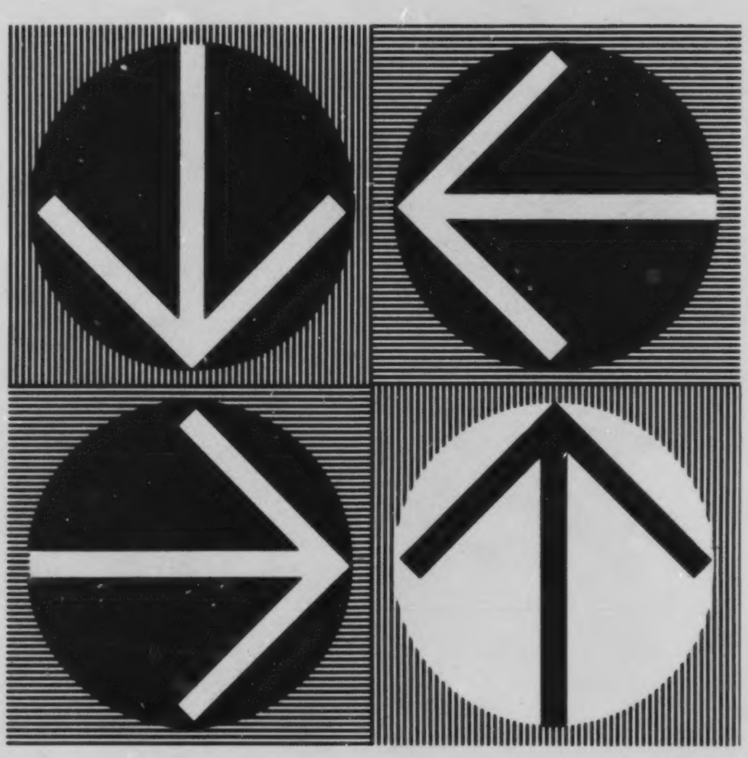

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PREFACE

As the allied health occupations continue to grow, and allied health personnel play an increasing role in the health care delivery system, the need for reliable, continuous data on the supply, composition, and requirements for the allied health work force becomes more urgent. Recognizing that allied health personnel constitute a substantial majority of the health work force in the United States, the Division of Health Professions Analysis, Bureau of Health Professions, determined that further study of these occupations was necessary if adequate informaton was to be made available for health planning and policy formulation purposes.

This report presents the results of two Federally supported contracts evaluating existing data sources for selected allied health occupations, developing improved data collection strategies for these occupations, as well as improving procedures for estimation of allied health manpower requirements. The contractor, Applied Management Sciences, Inc., of Silver Spring, Maryland developed an integrated approach for addressing key issues pertaining to both supply estimation and development of requirements. The contracts HRA 232-80-0038 and HRA 232-80-0043 were supported by the Division of Health Professions Analysis.

The Contract Project Directors were Kathryn Langwell and Joel Bobula of Applied Management Sciences. Also contributing to the development of the report were Stuart Bernstein, Project Officer, and Ernell Spratley, Division of Health Professions Analysis, Howard V. Stambler, Division Director. Guy Moore, Division Consultant, provided editing assistance. Rebecca Rutter, Betsy Aguino, Darnese Ferguson, Carolyn Conrad and Mary Morris of the Division typed the draft of the report.

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Chapter 1
Introduction

The availability of reliable data is an integral part of policy development. Without adequate data, there is no basis upon which to conduct analytical studies which provide a foundation for the resulting decisionmaking process. Accurate data on the supply of primary health care providers have been available from multiple sources for many years. This is due, in part, to the well defined educational requirements and work roles of physicians, dentists, registered nurses, and other primary health care providers. It has, therefore, been possible to evaluate the adequacy of the current supply, as well as to forecast the future supply of and demand for these professionals. Data on the supply, distribution, and characteristics of allied health practitioners have not been available at the same level of reliability and consistency.

The Division of Associated Health Professions, in A Report on Allied Health Personnel prepared for the United States Congress, enumerated a variety of problems associated with obtaining information on allied health care providers, including:

- the large number of persons employed in allied health occupations (estimated to be in excess of 3 million);
- the large number of allied health occupations (more than 100);
- the large number of employment settings in which allied health professionals work;
- the lack of licensure in all but one or two fields, which hinders data collection efforts;
- the rapid growth in numbers in recent years;
- the rapidly changing nature of many of the occupations; and
- the high degree of occupational mobility.

Preliminary studies indicate that appropriate utilization of allied care providers: (1) increases the productivity of physicians, dentists, and other health care providers; (2) permits the provision of additional services in areas thought to be underserved; (3) reduces the unit costs of producing medical care services; and (4) provides a more efficient organization of medical care delivery. Evidence relating the employment of auxiliary medical personnel to physician and dentist productivity is clear. As the allied health occupations continue to grow, and allied health personnel play an increasing role in the health care delivery system, the need for reliable, continuous data on the supply and composition of the allied health work force becomes more urgent.

Although there are over one hundred allied health occupations, this project focused on 21 occupations in nine clusters as shown in table 1. These occupations constitute those which are the most clearly defined, generally requiring formal educational preparation and, in some instances, licensure or certification.

The two major objectives of this project were to assess the adequacy of existing data sources on the supply of these 21 allied health occupations, in order to develop alternative methodological strategies for collecting supply data for those occupations for which reliable national estimates are not currently available, and to develop strategies for improving procedures for estimation of requirements for these occupations.

Toward the accomplishment of these objectives a number of tasks were completed.

This report presents a comprehensive overview of the purpose, approach, and results of this project. Chapter 2 provides a discussion of the general phases of the project which included:

- assembly and evaluation of available estimates of the supply of allied health personnel, by occupation, from a variety of sources;
- development of methodological approaches that appear feasible for collecting data on those occupations for which reliable national supply estimates are not currently available;
- a review of the literature to identify, examine, and consider alternative approaches to estimating requirements for allied health personnel;
- development of recommendations for utilizing existing data for estimation of requirements for allied health personnel;
- the conduct of occupation-specific interviews to elicit information on factors affecting each profession and on current and future requirements for that occupation;
- the conduct of four Special Research Topics related to estimation of requirements for allied health personnel;
- the development of general and specific recommendations for procedures to improve estimates of requirements for allied health personnel and a detailed assessment of currently feasible approaches to requirements estimation for each of the occupations being studied; and

- estimation of national and state personnel-to-population ratios for each occupation for which reliable data are available.

General recommendations for improving procedures for estimation of supply and requirements as well as a full description of the evaluation of methodology upon which the development of recommendation was based are also presented in Chapter 2. Chapters 3 to 11 contain individual reports and recommendations for each of the 21 occupations within the nine occupational clusters included in this study. For each occupation, the discussion includes:

- an overview of the occupation;
- definition of the population within the occupation;
- a description and assessment of data sources;
- recommendations for estimating the supply within each occupation;
- recommendations for estimating current requirements; and
- recommendations for estimating future requirements.

Additionally, each chapter contains a summary of the findings of the interviews conducted with individuals knowledgeable of the cluster and personnel-to-population ratios for each occupation for which data were available.

TABLE 1: OCCUPATIONAL CLASSIFICATION

1. Clinical Laboratory Services
    a. Medical Technologist
    b. Medical Laboratory Technician
    c. Cytotechnologist
2. Dental Auxiliary Services
    a. Dental Hygienist
    b. Dental Assistant
    c. Dental Laboratory Technician
3. Dietetic Services
    a. Dietitian
    b. Dietetic Technician
4. Medical Record Services
    a. Medical Record Administrator
    b. Medical Record Technician
5. Occupational Therapy
    a. Occupational Therapist
    b. Occupational Therapy Assistant
6. Physical Therapy
    a. Physical Therapist
    b. Physical Therapist Assistant
7. Radiologic Technology
    a. Radiographer
    b. Nuclear Medicine Technologist
    c. Radiation Therapy Technologist
8. Respiratory Therapy
    a. Respiratory Therapist
    b. Respiratory Therapy Technician
9. Speech and Hearing Services
    a. Speech and Language Pathologist
    b. Audiologist

Chapter 2
Overview of Methodological Approaches and General Recommendations

GENERATING ESTIMATES OF THE SUPPLY OF ALLIED HEALTH PERSONNEL

The first phase of the project consisted of an evaluation of existing data sources on the supply of allied health care providers. The assessment of data collection methodologies and estimates from work force surveys, household surveys, and professional associations permitted the determination of occupations and employment settings for which consistent estimates of the supply of allied health personnel currently exist. Based on the results of this evaluation, alternative methodological strategies were developed for collecting data on those occupations and employment settings for which reliable national estimates are not currently available.

The purpose of this section of the chapter is threefold: (1) to describe the major sources of information on allied health personnel; (2) to provide an overview of the results of the evaluation of the major data sources; and (3) to provide an overview of alternative methodological approaches that appear to be feasible for generating reliable supply estimates.

The second section of this chapter provides an overview of the phases of the study designed to develop and initiate a protocol and research plan for the derivation of appropriate criteria to indicate current and future requirements for the allied health personnel discussed in this section of the chapter.

Data Sources

The major sources of information on allied health personnel include: (1) work force surveys conducted by federal agencies involved in allied health data collection; (2) household surveys conducted by the U.S. Bureau of the Census; and (3) professional associations in the allied health field. A brief description of the three major sources of data follows.

Work Force Survey Data Sources: A number of work force data collection efforts have been conducted by various federal agencies. Four recent efforts which contain information on a number of allied health occupations are described below:[1]

(1) Occupational Employment Statistics Survey (BLS). The most recent Bureau of Labor Statistics survey was initiated in 1978, and is scheduled to be conducted by mail triennially on a sample of establishments in the nonfarm sector of the economy to obtain employment data for approximately 2,000 occupations. The survey is conducted over a three-year cycle as follows: manufacturing industries are surveyed during the first year; one-half of all nonmanufacturing industries are surveyed during the second year; and the remainder of the nonmanufacturing industries are surveyed during the third year.

The sampling frame for the BLS survey consists of all establishments covered under State Unemployment Insurance Laws. To improve the efficiency of the sampling procedure, the universe of employees is stratified by industry and size of establishment. (Staffing patterns have been found in previous Bureau of Labor Statistics' surveys to be similar within companies in the same industry and of the same size.) Sample selection procedures are designed to produce relative standard errors of the estimates on the order of five to ten percent for major occupations at the industry level. Response rates vary from industry to industry; however, the Bureau attempts to maintain a minimum response rate of 70 percent by means of telephone and in-person follow-up efforts.

Preliminary data have been made available to Applied Management Sciences' staff for the sole purpose of this study. As such, no data from the BLS survey may appear in this report since the estimates are considered preliminary and are not to be published or quoted. The BLS survey contains estimates for most of the occupations under study. In a few instances, some of the occupations have been grouped together under a more general heading (e.g., speech-language pathologists and audiologists are combined into one category rather than treated as two separate occupations).

Estimates from the BLS survey are available for industries at the three-digit Standard Industrial Classification (SIC) level. However, there are two employment settings for which data are still being compiled--the hospital industry (SIC code 806) and the education industries (SIC codes 830-839). The Bureau of Labor Statistics has provided Applied Management Sciences staff with estimates for these two industries from previous Bureau efforts. The hospital data are from a joint National Center for Health Statistics-Bureau of Labor Statistics survey that will be described below. The education data have been assembled by the Bureau of Labor Statistics from surveys conducted by the National Center for Education Statistics.

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[1] Federally sponsored surveys conducted by professional associations are discussed in the relevant chapter for that profession.

(2) National Nursing Home Survey (NCHS-NNHS). The 1977 NCHS-NNHS was the second of two nursing home data collection efforts conducted by the National Center for Health Statistics, the first having been conducted in 1973-74. The 1977 NCHS-NNHS was based on a stratified sample of nursing homes listed in the 1973 Master Facility Inventory maintained by the National Center for Health Statistics, as well as nursing homes opening for business between 1973 and 1977 (an additional eight percent). The types of nursing homes covered in the NCHS-NNHS included: nursing care homes; personal care homes with nursing; personal care homes; and domiciliary care homes. The definition of a nursing home used in the NCHS-NNHS is in approximate agreement with the SIC code for nursing homes used in the BLS survey with the exception that homes for the retarded, with health care, are considered nursing homes by the Bureau of Labor Statistics but not by the National Center for Health Statistics.

The NCHS-NNHS used trained interviewers to obtain information from employers on all staff providing direct or health-related services in nursing homes. A concerted effort was made to identify personnel employed on a contract basis. Eight of the 21 occupations under study were included in the NCHS-NNHS survey. The response rate to this survey was 81 percent and the relative standard error of the estimates is in the five to ten percent range.

(3) Survey of Hospital Staff (NCHS-SHS). A third federal agency work force data collection effort is the joint National Center for Health Statistics-Bureau of Labor Statistics Survey of Hospital Staff conducted in 1976-1977. The NCHS-SHS mail survey was an attempt to obtain, from hospital administrators, a complete enumeration of all full-time and part-time hospital staff in all short-term and long-term, federal and nonfederal hospitals in the United States. The survey covered all of the occupations under study. However, in some cases certain occupations were grouped together under a more general category. (For example, the survey collected data for the category "dental auxiliaries," rather than "dental hygienists," "dental laboratory technicians," and "dental assistants.")

The initial survey effort conducted in 1976 yielded a response rate of 45 percent, which was considered too low to be useful for generating national estimates of hospital staff. Hence, in early 1977, a shortened version of the questionnaire was sent to nonrespondents. The response rate for the combined survey efforts was 69 percent. National estimates were obtained by weighting the respondents on the basis of two variables, the total number of employees and the type of ownership of the hospital. Since data were available for these two variables for respondents and nonrespondents alike, the survey results could be extrapolated to the national level on this basis.

(4) The Allied Health Employment Matrix (AHEM). In 1975, the Division of Associated Health Professions of the Bureau of Health Professions funded a study to begin to assemble a national data base for all allied health occupations. This data base is the Allied Health Employment Matrix. An additional contract to refine, expand, and

update the matrix was awarded by the Division of Associated Health Professions in 1977. The purpose of the AHEM project was to assemble data on employment for a minimum of 48 allied health occupations by state, employment setting, and employment status for the years 1973 to 1979. The AHEM project consisted of a nationwide search for, and evaluation of, original source documents at the subnational level. The data comprising the AHEM were obtained from over 200 different data collection efforts. As a result, the form of the reported data for a given occupation varies widely.

Procedures were developed in the course of the AHEM project to enable national estimates to be prepared from the varied and fragmentary sources for 15 of the 21 occupations under study. All documents were screened initially to determine whether the documents were acceptable for further consideration. The criteria used to determine technical acceptability of the data included the following:

- response rate of 70 percent or greater;
- sampling technique adequately described and considered acceptable; and
- the data collection methodology adequately described and considered acceptable.

Table 2.1 summarizes the outcome of the technical screening and the resulting number of states providing acceptable data for each of the 15 occupations.

As not all states provided data in the same form, it was necessary to develop a common base in order to combine data from various sources. Thus, procedures were designed to: (1) convert the available data to a common form; and (2) estimate national employment using only those states for which suitable data were available. Available data had to be inflated to estimate United States totals, as there were no professions for which all 50 states and the District of Columbia could provide data.

Household Survey Data Sources: There are two U.S. Bureau of the Census household surveys that collect information on allied health personnel. These are:

(1) Census of Population. The 1970 decennial census was conducted primarily through self-enumeration using a mail questionnaire. Three types of questionnaires were used throughout the country: (1) 80 percent of all households were asked to complete a form containing a limited number of population and housing questions; (2) 15 percent completed forms which contained these questions as well as a number of additional questions concerning social and economic characteristics of the household; and (3) 5 percent completed forms which also contained a number of additional questions, some of which were the same as the 15 percent version. A random procedure was used to determine which of the three forms any particular household received.

Information on occupation, industry of employment, and employment status was sought in both the 15 percent and 5 percent versions of the questionnaire. Thus, Bureau of the Census estimates of the number of employed persons in selected health occupations and employment settings are based on a 20 percent sample of the U.S. population. (More detailed statistics of the employed population may be based on a 20, 15, or 5 percent sample depending on whether the same information was sought on both the 15 percent and 5 percent versions of the questionnaire.)

Information on occupation was sought for persons in the sample aged 14 and above, in the civilian labor force or labor reserve. Employed persons were asked for their current occupations; experienced unemployed persons in the labor reserve were asked for their most recent occupations. In addition to this information, the 1970 questionnaires asked for a brief description of the most important occupational activities. This information was used by processing clerks to classify accurately each respondent into one of 12 major occupational groups and, then, into the appropriate occupation according to the Classified Index of Occupations.

Data are collected descriptive of the employment setting or industry. Industry is categorized according to the Classified Index of Industries using Standard Industrial Classification (SIC) codes.

Census questionnaires are, for the most part, completed without the benefit of a follow-up interview. Internal inconsistencies in responses to different questionnaire items are identified by Census staff and corrected, to the extent possible, during the editing process. However, the quality of the data provided in a self-enumerated survey may be lower, as compared with personal or telephone interviews, since there is no opportunity to clarify directly ambiguous or suspect responses. Hence, there is a greater likelihood of response error that cannot be detected.

(2) Current Population Surveys. Statistics on the occupation, employment status, and other characteristics of a sample of the U.S. population are compiled for the Bureau of Labor Statistics, Department of Labor, by the Bureau of the Census in the Current Population Survey (CPS). Data are collected through personal interviews with approximately 65,000 households each month and include such characteristics as age, sex, race, family relationships, marital status, occupation, and industry attachment. Sample results are weighted to produce U.S. totals which appear in the Bureau of Labor Statistics' monthly publication, Employment and Earnings.

The Bureau of Labor Statistics' definition of employed persons:

- includes wage and salary workers, self-employed persons, and unpaid workers who worked 15 hours or more during the survey week in family-operated enterprises;

- includes those employed in both agricultural and nonagricultural industries;

- includes employed persons holding more than one job only once--at the job at which they work the greatest number of hours. (Note that this precludes double-counting, which is a problem for employer-based surveys.);

- includes people who held jobs but were not at work during the survey week (due to illness, vacation, strike, or other temporary absence), even if the employee was not paid for the time off; and

- excludes people who only worked around the house, or who volunteered for religious, charitable, and similar organizations.

Published data from Employment and Earnings include estimates for only four occupations--dietitians, therapists, clinical laboratory technologists and technicians, and radiologic technologists and technicians. However, Applied Management Sciences was able to obtain unpublished data from the Current Population Surveys for the years 1972-79 made available by the Bureau of Labor Statistics for purposes of this project. The unpublished data correspond to the occupational classifications used by the U.S. Bureau of the Census for the 1970 decennial census.

Responses to the Current Population Survey are obtained by means of a personal interview. Personal interviews have the potential to yield more reliable information than self-enumerated surveys for the following reasons: 1) responses frequently can be verified on-site; 2) it affords the opportunity to clarify questions in case they are misunderstood by the respondent; 3) it provides the interviewer with the opportunity to probe ambiguous or suspect responses; and 4) there is a greater tendency for respondents to elaborate on their answers in a face-to-face setting. The impact of the type of data collection instrument on the estimates of the number of employed individuals in selected health occupations is discussed below in a subsequent section of this chapter.

Professional Association Studies: There is at least one professional association representing each of the nine allied health occupational clusters under study for this contract. These associations serve many functions, among these are credentialing, representing the interests of the occupation, and data collection. It is this last role that is of interest in the current project.

Data on allied health personnel from professional associations are of two general types. First, associations routinely collect or obtain a certain amount of biographic information on the members of the association. Second, a number of the associations have conducted surveys of their membership in which more detailed information on the educational background, training, and employment characteristics is sought. In both cases, the relationship between the survey universe (i.e., members of the

TABLE 2.1: RESULTS OF TECHNICAL SCREENING FOR AHEM BY OCCUPATION

Cluster/ Profession	Number of States Included		
	Before Screening	After Screening	% of U.S. Population
1. Clinical Laboratory Services			
Medical Technologists	33[1/]	18[1/]	43.9%
Medical Laboratory Technicians[2/]	22	15	38.9
Cytotechnologists	*	*	*
2. Dental Auxiliary Services	*	*	*
3. Dietetic Services			
Dietitians	31	26	55.5%
Dietetic Technicians	12	10	26.3
4. Medical Record Services			
Medical Record Administrators	25	23	52.6%
Medical Record Technicians	18	13	34.9
5. Occupational Therapy			
Occupational Therapists	36[1/]	25[1/]	52.3%
Occupational Therapy Assistants[3/]	18	15	36.6
6. Physical Therapy			
Physical Therapists	51[1/]	31[1/]	60.6%
Physical Therapist Assistants	19[4/]	19[4/]	23.0
7. Radiologic Technology	36[1/]	27[1/]	65.7%
8. Respiratory Therapy Services			
Respiratory Therapists	21[1/,5/]	18[1/,5/]	33.1%
Respiratory Therapy Technicians	13[5]	12[5]	15.7
9. Speech and Hearing			
Speech-Language Pathologist	15[1/]	7[6/]	15.0%
Audiologist	10	9	17.6

TABLE 2.1: (Continued)

(*) Indicates that data were not collected for AHEM for these clusters or professions.

1/ Includes the District of Columbia.

2/ Estimates provided for both registered and all medical laboratory technicians.

3/ Includes only certified occupational therapy assistants.

4/ Eight states were included in the original sample of physical therapist assistants. The data from these states, comprising 17.5% of the total United States population, were used to estimate the number of certified physical therapist assistants. In addition, data were available from twelve states to estimate physical therapist assistants and aides. One state, Alabama, is included in both samples. The 23% U.S. coverage figure pertains to the twelve-state sample.

5/ In the original sample of therapists, 14 states reported all respiratory therapists, five reported only registered respiratory therapists, and two reported both all therapists and registered therapists. After screening, the figures were eleven, five and two, respectively. Estimates were calculated for both classifications. Respiratory therapy assistants were reported similarly. Before screening, nine states reported all respiratory therapy assistants and four reported both all and registered respiratory therapists. One state's data from the former group were rejected after screening. Again, estimates were calculated for both cases.

6/ Only five states' data remained after initial screening. Two additional states, Connecticut and New Jersey, provided acceptable data for "speech-language pathologists and audiologists." In an attempt to decrease the geographic and sociodemographic bias that the smaller five-state sample introduced, these two states were included, thus creating a seven-state sample. The figures resulting from the extrapolation should, therefore, be approached with caution.

Source: Applied Management Sciences, Evaluation of Data Procedures and Estimates Derived from Multiple Sources, Interim Report on Contract No. HRA 232-80-0043, October 1980, Table 2.1.

association) and the total population in the profession (i.e., members and nonmembers) is very often not one-to-one. This issue, more than any other, is the most important characteristic that distinguishes the professional association studies from the others.

With one exception, professional association data collection efforts are concerned with a single occupation or field. Given this fact, and given the number of professional association studies that have been conducted, a description of each study will be deferred to the relevant chapter that deals with the specific occupation. One professional association effort, however, deals with a number of allied health occupations and is described below.

In 1973, the American Hospital Association conducted the Survey of Selected Hospital Manpower, funded by the Division of Manpower Intelligence of the Bureau of Health Resources Development (now the Division of Health Professions Analysis of the Bureau of Health Professions). This was the third of three surveys of hospital personnel conducted by the American Hospital Association either as the sole collecting agent or in collaboration with other federal agencies. The first was conducted in 1966, and the second in 1969. Twelve of the 21 occupations under study in this current effort were included in the 1973 survey. The sampling frame for the AHA study consisted of 5,737 community hospitals in the United States registered with the American Hospital Association. A stratified sample of 879 hospitals was selected, of which 780 responded for a response rate of 88.7 percent. National estimates were obtained by extrapolation of the survey results from all sample hospitals in a given stratum to a universe value for that stratum, and then by summing the universe data for each individual stratum. The American Hospital Association recently completed a survey of hospital personnel for 1980. However data from that survey were not available at the time that this study was conducted.

Evaluation of Data Sources

Data collection efforts conducted in each of the 21 allied health fields under study were evaluated on the basis of three criteria:

- correspondence among operational definitions of the occupation which have been employed in the data collection efforts;
- the periodicity of the data collection effort; and
- the consistency of the estimate in comparison with other estimates for the occupation.

An overview of the results of the evaluation for each major data source is presented below in terms of the evaluation criteria outlined above. In addition, a summary of the consistency of the estimates by data source and occupation is presented in Table 2.2. Detailed specific findings for each of the 21 occupations under investigation are reported in Chapters 3 through 11 of this report.

TABLE 2.2: SUMMARY OF DATA AVAILABILITY AND CONSISTENCY OF DATA ON SUPPLY OF ALLIED HEALTH PERSONNEL

Occupation	Data Source*	Level of Consistency**
Clinical Laboratory Services		
Medical Technologists	BLS	High
	NCHS-SHS1/	High
	AHEM	High
	AHA2/	High
	CDC-ASMT3/	High
	ASMT-Census4/	High
Medical Laboratory Technicians	NCHS-SHS1/	Low
	AHEM	Low
	CDC-ASMT3/	Low
	ASMT-Census4/	Low
Cytotechnologists	BLS	High
	NCHS-SHS1/	High
	AHA2/	Unassessable
	CDC-ASMT3/	High
	ASMT-Census4/	Low
Dental Auxiliary Services		
Dental Hygienists	BLS	Low
	HRA	High
	CPS	High
	Census	High
Dental Assistants	BLS	High
	HRA	Low
	CPS	High
	Census	High
Dental Laboratory Technicians	HRA	High
	CPS	High
	Census	High
Dietetic Services		
Dietitians	BLS	Unassessable
	NCHS-SHS1/	High
	NCHS-NNHS5/	Low
	AHEM	Low

TABLE 2.2: (Cont.)

Occupation	Data Source*	Level of Consistency**
Dietitians (Cont.)	AHA	Low
	CPS	Low
	Census	Low
	ADA	Unassessable
Dietetic Technicians	BLS	Low
	NCHS-SHS[1]	Unassessable
	AHEM	Low
	AHA[2]	Unassessable
	ADA	Low
Medical Record Services		
Total Personnel	BLS	Low
	NCHS-NNHS[5]	Low
	AHEM	Unassessable
	AHA[2]	Low
	CPS	Low
	Census	Low
Medical Record Administrators	NCHS-SHS[1]	High
	NCHS-NNHS[5]	Unassessable
	AHEM	High
	AHA[2]	High
	AMRA	High
Medical Record Technicians	NCHS-SHS[1]	Low
	NCHS-NNHS[5]	Unassessable
	AHEM	Low
	AHA[2]	Low
	AMRA	Low
Occupational Therapy		
Occupational Therapists	BLS	High
	NCHS-SHS[1]	Low
	NCHS-NNHS[5]	Low
	AHEM	Low
	AHA[2]	Low
	AOTA	High
Occupational Therapist Assistants	NCHS-SHS[1]	Low
	NCHS-NNHS[5]	Low
	AHA[2]	Low

TABLE 2.2: (Cont.)

Occupation	Data Source*	Level of Consistency**
Physical Therapy		
Physical Therapists	BLS	High
	NCHS-SHS[1]	High
	NCHS-NNHS[5]	High
	AHEM	High
	AHA[2]	High
	APTA	High
Physical Therapist Assistants	BLS	Low
	NCHS-SHS[1]	Low
	NCHS-NNHS[5]	Low
	AHEM	Low
	AHA[2]	Low
	APTA	Low
Radiologic Technology		
Total Personnel	BLS	High
	NCHS-SHS[1]	High
	CPS	High
	Census	High
Radiographers	AHEM	Low
	AHA[2]	Unassessable
	ACR-ASRT	Low
Nuclear Medicine Technologists	No separate estimates	
Radiation Therapy Technologists	No separate estimates	
Respiratory Therapy		
Total Personnel	NCHS-SHS[1]	Unassessable
	AHEM	Low
	AHA[2]	Unassessable
	AART	Low

TABLE 2.2 (Cont.)

Occupation	Data Source*	Level of Consistency**
Respiratory Therapists	BLS	Unassessable
	NCHS-SHS[1]	Unassessable
	AHEM	Low
	AART	Low
Respiratory Therapy Technicians	NCHS-SHS[1]	Unassessable
	AHEM	Low
	AART	Low
Speech-Language and Hearing		
Total Personnel	AHEM	Low
	ASHA 72/73	Low
	ASHA 78	Low
	BLS	Low
	NCHS-SHS[1]	Low
	NCHS-NNHS[3]	Low
Speech-Language Pathologists	AHEM	Low
	ASHA 72/73	Low
Audiologists	AHEM	Low
	ASHA 72/73	Low

*Data Sources:

BLS--Bureau of Labor Statistics
NCHS-SHS--National Center for Health Statistics-Survey of Hospital Staff
NCHS-NNHS--National Center for Health Statistics-National Nursing Home Survey
AHEM--Allied Health Employment Matrix
AHA--American Hospital Association
HRA--Health Resources Administration
CPS--Current Population Survey
Census--1970 Decennial Census
CDC-ASMT--Center for Disease Control
ASMT-Census--American Society of Medical Technologists
ADA--American Dietetics Association
AMRA--American Medical Record Association
AOTA--American Occupational Therapy Association
APTA--American Physical Therapy Association
ACR-ASRT--American Council on Radiology-American Society of Radiologic Technology

TABLE 2.2: (Cont.)

AART--American Association of Respiratory Therapists
ASHA--American Speech-Language-Hearing Association

**The definition of a "high" level of consistency for a specific estimate is that it be within 5 percent of agreement with other independent estimates.

Notes:

1/NCHS-SHS estimates are for hospitals only.

2/AHA estimates are for hospitals only.

3/CDC-ASMT estimates are for hospitals and laboratories only.

4/ASMT-Census estimates are for hospitals and laboratories only.

5/NCHS-NNHS estimates are for nursing homes only.

Work Force Survey Data Sources: With respect to the appropriateness of the methodologies used to collect data in the federal agency studies, it is important to note that all of the studies are employer-based rather than employee-based. Thus, the possibility exists that some workers may be counted more than once due to the presence of multiple job holders. The number of individuals working for more than one employer in the allied health field is unknown; however, this issue is particularly acute in the National Nursing Home Survey in which trained interviewers made a concerted effort to enumerate individuals working in nursing homes on a contract basis. Employees working on a contract basis may be more likely to hold multiple positions than full-time salaried employees in a nursing home. In fact, estimates from the NCHS-NNHS survey for many of the occupations were found to exceed estimates of the number of employees in nursing homes from other studies.

In terms of the evaluation criteria outlined above, most of the occupations under investigation in this report are covered in the federal agency work force surveys. However, some occupations are aggregated in the survey instruments and do not provide the refinement necessary for health planners in the allied health field. Federal agency studies also use the least restrictive definition of an allied health occupation. The surveys elicit information from employers on the number of credentialed and noncredentialed individuals employed in the occupation. As a result, estimates from federal agency studies very often exceed estimates from professional associations and state licensing boards, sometimes by a wide margin. However, the definitions of the occupations employed in the federal agency surveys were generally consistent with the definitions of allied health occupations employed in other data collection efforts.

Only the Bureau of Labor Statistics Occupational Employment Statistics survey is conducted on a regular basis. The most recent BLS survey was conducted in 1978 and is scheduled to be repeated on a triennial basis. Neither of the NCHS surveys will be repeated on a regular basis.

In general, the federal agency work force surveys provided consistent estimates for the largest number of allied health occupations under investigation. In particular, the BLS survey produced estimates consistent with those from other sources for five of the 21 individual occupations under investigation and one of the nine clusters of occupations. Data collection procedures in the federal agency studies are generally of high quality. In the case of sample surveys, sampling frames are well defined, and samples are designed and selected to produce reliable estimates in an efficient manner. Standard procedures are used to screen and edit data for accuracy and consistency. Also, statistical techniques are used to adjust for nonresponse and noncoverage. Finally, relative standard errors are reported along with the employment estimates to provide the reader with some indication of the range in which the true value may lie.

Estimates consistent with other data sources were obtained from the triennial BLS survey for the total supply of the following individual occupations:

- medical technologists;
- cytotechnologists;
- dental assistants;
- occupational therapists; and
- physical therapists.

The Allied Health Employment Matrix (AHEM) has been used to estimate the supply of allied health personnel for 15 occupations in 1976. The AHEM project is not conducted on a regular basis, although the estimation procedure theoretically could be used to provide estimates for any desired year.[2]

In general, the AHEM estimates were inconsistent with the estimates from other sources. Consistent estimates were obtained for only those occupations where the sample of states used to produce national estimates represented a large fraction of the U.S. population. The smaller the sample of states used in the estimation procedure, the greater the likelihood that the estimate will differ from estimates from other sources, often by a wide margin. This is due to the fact that the extrapolation procedures used in the estimation process are sensitive to the representativeness of the sample of states and to the quality of the data reported by the states. Consistent estimates of the national supply of allied health personnel were developed by AHEM only for physical therapists.

The estimate of the number of physical therapists was based on state-level data representing 60.6 percent of the U.S. population. Given the large sample of states for which data were available, it is not surprising that the AHEM procedure produced an estimate for this occupation that was consistent with other data sources. However, the estimates for the other 14 occupations were based on a smaller number of states (and a correspondingly lower percentage of the U.S. population), and the estimates are less consistent with the estimates from other data sources.

Accuracy of AHEM estimates was also influenced by the fact that definitions of occupations, employment settings, and full-time/part-time status used in the AHEM project were dependent on the definitions used in the state-level studies that comprise the AHEM. For example, national estimates of speech-language pathologists are based on a small sample of states, some of which reported certified speech-language pathologists, some of which provided estimates of certified and noncertified speech-language pathologists, and some of which reported a combined figure for speech pathologists and/or audiologists. Although efforts were made to standardize definitions, the possibility still exists that such after-the-fact efforts may not be complete.

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[2] However, the estimation procedure is extremely data intensive. The effort needed to amass data from 51 jurisdictions is considerable. Thus, it may not be feasible to update the AHEM on a continual basis due to the resources and time required to produce the estimates.

Household Survey Data Sources: With respect to the appropriateness of the methodologies used to collect data in the household studies, the most important issue is the potential for self-reporting bias. The self-reporting bias issue involves the tendency of individuals to report themselves at a higher occupational level than they are employed. This problem was found to be particularly acute in the case of dietitians. However, no evidence of self-reporting bias was found in the dental auxiliary occupations (i.e., dental hygienists, dental assistants, and dental laboratory technicians). The extent to which such a bias may exist among the other allied health occupations has yet to be determined.

In terms of the evaluation criteria outlined earlier, the most significant problem encountered when examining the CPS and Census estimates is the broadness of the occupational categories used. Of the 21 allied health occupations of interest to this report, only four are covered at the individual occupation level in the household surveys; these four are dietitians and the three dental auxiliary occupations. Two additional occupational clusters, radiologic technologists and medical record personnel, correspond well to Census and CPS categories. The category "clinical laboratory technologists and technicians" includes not only the clinical laboratory occupations of interest to this report, but also a substantial number of other occupations. Similarly, all therapists are combined into one category by Census and CPS, as are therapy assistants. The possibility for assessing household survey estimates relative to estimates from other sources, then, exists for only four occupations and two additional occupational clusters.[3/]

In most of those cases in which Census and CPS occupational categories were comparable with other sources on the individual occupation level, the household surveys produce consistent estimates. Census and CPS estimates are consistent for the following three occupations:

- dental hygienists;
- dental assistants; and
- dental laboratory technicians.

[3/] In preparing its estimates from the 1980 Census, the Census Bureau is now using a new occupational classification system which will allow for the identification of specific types of therapists.

These estimates are consistent both for total supply and for supply by employment settings. There is one individual occupation for which the household surveys produced inconsistent estimates--dietitians. The household sources apparently use a broader definition of the occupation than is used by other sources since the estimated supply of dietitians from the household surveys was found to exceed the work force survey estimates by a wide margin.

Census and CPS also produce consistent estimates of the total supply and the supply by employment setting of radiologic technologists. The other allied health categories reported by Census and CPS, "clinical laboratory technologists and technicians," "therapists" and "therapy assistants," are all too broadly inclusive to be comparable to estimates from other sources.

One drawback to the Current Population Survey is the relatively small sample size upon which the estimates are based. In occupations with relatively few practitioners, the sampling error can be substantial. In professions with 10,000 estimated practitioners, for example, the actual total participation could be between 6,000 and 14,000 (a relative standard error of 40 percent). Occupations reportedly employing 100,000 persons would have a relative standard error of approximately 12 percent.

Professional Association Studies: In most cases, professional associations maintain rosters of membership or credentialing from which survey samples are drawn. Since there is not usually a one-to-one relationship between this survey universe and all practitioners in the field, the professional associations can only provide information on a subset of any given occupation. The issue of a lack of correspondence between the survey universe and all persons employed in an occupation is the single most important characteristic separating the professional association studies from others.

There are occupations for which licensure is required universally (e.g., physical therapy) and others for which credentialing is voluntary, but a large proportion of the work force holds credentials (e.g., dietitians, occupational therapists). In these cases, the issue of extrapolating the subset to the whole is a minor one, and the effects of any resulting bias may be assumed to be small. This is generally the case with some of the upper-tier allied health professions. The problem is most obvious in those occupations for which professional association membership or credentialed individuals represent only a small proportion of the total work force. This is typically the case with second-tier occupations (e.g. dietetic technicians, occupational therapy assistants).

While there is the obvious point of divergence between definitions used by professional associations and those adopted by other data collectors, differences are also found in criteria for determining full-time/part-time status, employment setting, and other descriptive characteristics.

Professional associations generally update membership data on an annual basis. These data also may include estimates of credentialed individuals. The usefulness of membership and credentialing data is limited, however, by the absence of information on employment status and work force characteristics. That is to say that these data would not provide sufficient information with which to estimate the total supply of employed personnel for those occupations with a large percentage of the work force who are inactive, without credentials, or not members of an association. Thus, these annual data, while providing longitudinal estimates of the number of individuals who are credentialed or members of an association, may not be the best estimators of the total supply of active personnel.

In addition to annual membership figures, detailed employment surveys also are conducted by some professional associations, but only on an ad hoc basis. Because these surveys are generally restricted to members of the association, the resulting estimates of the total active supply within an occupation are generally low. Clearly, in those professions with high proportions of certificants or association members, the undercount is not as severe as in those occupations poorly represented in the associations.

For the nine allied health occupational clusters under study, few clear patterns emerge when examining these data sources. It appears that the associations provide "better" estimates for first-tier professions than for the second-tier occupations. Estimates consistent with other estimates of the total supply of personnel were obtained from professional association studies for the following allied health occupations:

- occupational therapists; and
- physical therapists.

To repeat, the major shortcoming of most professional association sources is the absence of an attempt to assess the relationship between the survey universe used in the study and the total number of professionals employed in the field. As a result, not only will these sources provide underestimates, but the characteristics of the professionals who choose not to join these associations will remain unknown.

The American Hospital Association (AHA) survey described earlier provided estimates for twelve occupations under investigation for the year 1973. All personnel were included, regardless of registration or certification status, and separate estimates were provided according to full-time/part-time status. AHA's definitions for upper-tier personnel generally are consistent with those from other sources. This pertains to dietitians, medical technologists, medical record administrators, and occupational and physical therapists. The tendency with the second-tier occupations, however, is to include all support staff (i.e., technicians, assistants, and aides), thus setting more liberal limits for defining the population.

The results of the AHA survey do not lend themselves to generalization. In approximately as many cases as not, AHA provides estimates consistent with those from other sources. However, these consistent estimates are not confined to first-tier positions, nor are the inconsistent estimates limited to second-tier occupations.

General Recommendations for Procedures to Improve Supply Estimates

Based on the results of the evaluation of existing sources of information on the supply of allied health personnel methodological strategies were developed for collecting data on those occupations and employment settings for which consistent national estimates were not available. In this section, a discussion of the methodological issues involved in developing supply estimates for different occupations of allied health personnel is presented with an overview of the various methodological approaches that could be implemented to resolve these issues.

The results of the first phase of this study indicate that the 21 allied health occupations under investigation fall into one of four categories:

> Category 1: Occupations for which reliable, continuous estimates are available.
>
> Category 2: Occupations for which reliable, continuous estimates are available at the cluster level, but not at the individual occupational level.
>
> Category 3: Occupations for which reliable, continuous estimates are available for the credentialed work force, but not for the total work force.
>
> Category 4: Occupations for which no reliable, continuous estimates are currently available.

General Methodological Approaches: The first issue to be resolved prior to developing alternative methodological approaches for generating reliable supply estimates was to determine the type(s) of data collection procedure(s) to be employed (e.g., household or work force surveys), and whether a single procedure or multiple procedures were required. The results of the general evaluation can be summarized as follows.

The work force surveys (in particular, the BLS survey) provided the most frequently consistent estimates of the allied health occupations under investigation. In general, data collection procedures in the federal agency work force studies were found to be of high quality. The only drawback to the use of the employer-based work force survey is that, for certain occupations, the possibility exists that some workers may be counted more than once due to the presence of multiple job holders.4/

Given the relatively strong performance of federal agency work force surveys, a work force survey, rather than household or professional association surveys, would appear to be the appropriate data collection procedure to collect supply data for the remaining occupations for which consistent estimates are not currently available and for which further data collection efforts are recommended. In addition, a single data collection instrument and survey effort would appear to be appropriate for this purpose. The general methodological approaches that appear to be feasible for generating reliable supply estimates for each of the four broad categories of occupations are outlined below.

Category 1. Occupations which are included in the first category can be characterized as follows: credentialing of workers in this category is either mandatory (e.g., physical therapists) or, if voluntary, includes almost the entire work force (e.g., occupational therapists); educational requirements for these occupations are relatively high; and, the roles of the personnel in this category are well understood, so that the definition of the allied health occupation covers a unique, identifiable class of workers. As a result of these factors, continuous, reliable estimates have been, and should continue to be, available for occupations included in this category. The following occupations are included in this Category:

- medical technologists;
- cytotechnologists;
- dental hygienists;
- dental assistants;
- dental laboratory technicians;
- occupational therapists; and
- physical therapists.

Recommendations For Category 1 Occupations: The Bureau of Labor Statistics' Occupational Employment Statistics survey provided consistent estimates for the largest number of allied health occupations under investigation. The most recent BLS survey was initiated in 1978 and the survey is scheduled to be repeated on a triennial basis. Estimates consistent with other data sources were obtained from the triennial BLS survey for the following individual occupations:

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[4] See Chapter for a discussion of the issue of multiple job holders in the dental hygiene profession.

- medical technologists;
- cytotechnologists;
- dental assistants;
- occupational therapists; and
- physical therapists.

Consistent estimates also were obtained from the triennial BLS survey for the radiologic technology occupational cluster.

Two household surveys conducted by the U.S. Bureau of the Census also provide reliable data on selected occupations of allied heath personnel. These are: (1) the decennial Census of Population; and (2) the Current Population Survey conducted on a monthly basis by the Bureau of the Census for the Bureau of Labor Statistics. The Bureau of the Census estimates are consistent for the following three occupations:

- dental hygienists;
- dental assistants; and
- dental laboratory technicians.

The Bureau of the Census also produces consistent estimates of the supply of radiologic technologists at the cluster level.

One major problem with the Bureau of the Census surveys (and, to a lesser extent, with the Bureau of Labor Statistics survey) is the broadness of some of the occupational categories used. Of the 21 allied health occupations of interest to this study, only four were covered at the individual occupational level in the Bureau of the Census surveys. Given the relatively strong performance of the BLS and Census surveys, it is recommended that every effort be made to include in the BLS and Census surveys those allied health occupations that are not currently covered in the BLS and Census data collection efforts.

Category 2. Occupations for which reliable, continuous estimates are available at the cluster level, but not for specific occupations within the cluster, include the three occupations that make up the radiologic technology cluster: radiographers; nuclear medicine technologists; and radiation therapy technologists. The major methodological issue prohibiting the development of reliable estimates for these occupations is that many workers qualify for classification in more than one of the occupations. The vast majority of the workers in this field are employed as radiographers; however, a small, but growing, percentage of radiologic technologists are specializing in the more recently emergent fields of nuclear medicine technology and radiation therapy technology. Since most nuclear medicine technologists and radiation therapy technologists have previous experience and training as radiographers, and are likely to be certified as radiographers as well as in nuclear medicine or radiation therapy, it is difficult to identify the size of the workforce of individual occupations within this cluster. In addition, there is evidence that, on occasion, individuals perform the functions of more than one occupation.

Recommendations For Category 2 Occupations: Since specific recommendations for this cluster are presented in Chapter 6, the reader is referred to that chapter for the methodological approach developed for obtaining reliable supply estimates for the second category of occupations.

Category 3. The third category includes those occupations for which consistent estimates are available for the number of credentialed workers, but not for the total supply of personnel in the field. The major difference between occupations included in the third category and occupations included in the first category is the proportion of workers in the field who are not credentialed. Educational requirements are relatively high for both categories. Also, the roles of the allied health personnel in both categories generally are well understood. However, a substantial portion of the work force in the occupations included in the third category are not credentialed, and there are no reliable estimates of the total supply of these workers. The following occupations are included in this category:

- dietitians;
- medical record administrators;
- speech-language pathologists; and
- audiologists.

The major methodological issue to be addressed for this category is the determination of the number of noncredentialed workers employed in each occupation.

Recommendations For Category 3 Occupations: The recommended approach would consist of collecting information on a random sample of personnel in each of these fields by means of an employer-based work force survey. The purpose of the survey would be to determine the ratio of credentialed to noncredentialed personnel in the sample. Since the number of active, credentialed personnel is known, the ratio obtained from the sample survey could be used to extrapolate the total supply of personnel in these fields. The sample size required to estimate this ratio is not very large. For a confidence level of 95 percent, a random sample of approximately 375 workers for each occupation drawn at random will provide an estimate of the credentialed to noncredentialed ratio with assurance of a sampling error not exceeding 5 percent. To reduce the sampling error to 3 percent, a sample of approximately 1,000 workers for each occupation would be required.

Sample selection procedures could be targeted to specific employment settings. Estimates of the distribution of Category 3 personnel by employment setting indicate that the vast majority of workers are employed in one or two employment settings. Hence, little precision will be lost if sample selection procedures are focused on these settings.

More specific guidelines for each of the occupations included in this category are presented in the relevant chapter that deals with specific recommendations for each occupation.

Category 4. The final category includes those occupations for which no continuous, consistent estimates are available. These fields can be characterized as follows: virtually all of the occupations are second-tier occupations (e.g., technicians, assistants) for which no consistent definition exists; there is a lack of well established educational requirements for these occupations, and a relatively small percentage of the work force obtains certification (if certification is available); many of the occupations are relatively new; and work duties are ill defined, and may overlap with the work duties of other support staff (e.g., aides, attendants) to such an extent that it is difficult to differentiate between the various categories of support staff. Hence, the most important methodological issue prohibiting the production of reliable estimates for occupations within this category is the lack of a standardized definition of the profession. The following occupations are included in this category:

- medical laboratory technicians;
- dietetic technicians;
- medical record technicians;
- occupational therapy assistants;
- physical therapist assistants;
- respiratory therapists; and
- respiratory therapy technicians.

Recommended approaches for collecting data on the occupations for which reliable national estimates are not currently available will vary, depending on the specific methodological issues which need to be addressed.

Recommendations For Category 4 Occupations: Since the most important issue prohibiting the collection of reliable estimates for these occupations is the lack of a consistent definition of the occupations, further data collection efforts or estimation procedures will be of little use until standard definitions of the occupations are established. This could be accomplished by means of well constructed role delineation studies of the occupations in question. The role delineation studies could consist of the administration of an in-depth questionnaire mailed to a randomly selected sample of workers in each occupation. The surveys would attempt to elicit detailed information on:

- job activities;
- job responsibilities;
- job title;
- educational background;
- credential status; and
- occupational training.

Such a survey would enable the construction of a profile of the different categories of employees working within the occupation.

The survey questionnaire could be developed as a cooperative venture with participants drawn from the relevant professional associations, employer associations (e.g., American Hospital Association), educators in the relevant fields and federal agencies involved in allied health personnel issues. The results of such studies should be used to establish criteria for defining the population for which information is sought. If well-defined occupational categories can be constructed, the final step would be to include the categories in ongoing data collection efforts that currently provide continuous, consistent estimates for other allied health occupations such as the Bureau of Labor Statistics' Occupational Employment Statistics survey or the Census Bureau's Census of Population or Current Population Survey.

GENERATING ESTIMATES OF REQUIREMENTS FOR ALLIED HEALTH PERSONNEL

While there are data available on supply and distribution of many allied health professionals, which appear to be adequate for at least preliminary evaluations, there has been almost a complete lack of available and coordinated findings on requirements for these allied health personnel categories. Consequently, prior to evaluation of whether current or projected shortages or maldistributions of allied health occupations exist, it was necessary to determine what criteria are appropriate to use in assessing requirements for such personnel.

A comprehensive approach was taken to acquiring a wide range of background information and relevant materials which could be used to provide a foundation upon which recommendations for development of requirements estimates for the allied health professions, generally, and for specific professions. These activities included:

- a thorough review of the existing literature on general methodological approaches to estimation of requirements for allied health personnel, including a search for previous estimates of requirements for specific allied health professions of interest;
- a review and asessment of data requirements and data availability;
- the conduct of intensive interviews with knowledgeable persons and practitioners in each of the occupational clusters being studied to acquire information on practice and educational characteristics, interrelationships among occupations, trends in utilization and insurance coverage, technological change affecting services delivery, and other relevant considerations; and
- the examination of several special research topics which provided information of interest to this study.

Each of these activities is summarized briefly in this chapter. General recommendations for the estimation of requirements for allied health professions are then provided.

Review of the Literature

The review of the literature, conducted as the first phase of this study, identified a number of different approaches to the estimation of requirements for health personnel. These approaches cover a wide range of analytical orientations and could potentially result in an equally wide range of policy conclusions. Two alternative, but not mutually exclusive, types of requirements criteria were recommended to provide the methodological framework for this study: (1) the "need" for health personnel; and (2) the "demand" for health personnel. These two approaches were selected for the following reasons: (1) they represent a range of values which should indicate, respectively, the upper boundary and lower boundary of requirements for allied health personnel; and (2) they are most compatible with the type and amount of data available.

Needs-Based Approach: The medical needs-based approach to estimating health work force requirements can be thought of as the estimation of an "ideal" number of health professionals--that is, the number that would be needed to serve the population in a given area if all health care conditions which needed treatment were, in fact, treated. To that extent, it serves as an upper bound for estimating personnel requirements. However, several limitations to this approach have been raised in our review of requirements methodologies.[5] First, health service needs, demand, and utilization are not equivalent. Thus, it is unrealistic to formulate health work force policies around a target that encompasses treating all needs, when services are actually provided in response to effective demand. Another weakness of this approach is that empirical data are not always available. For example, while morbidity estimates can usually be handled empirically, production function data (translating services to be produced into the work force required) are often based on professional judgment or average visit rates. Thus, estimates based on this type of approach are only as reliable as the judgment of the relevant individuals.

These criticisms of the needs-based approach are valid, and must be kept in mind when interpreting the requirements criteria to be developed; however, despite its drawbacks, the needs-based approach is useful as a methodology from which an indicator of maximum requirements for allied health personnel may be derived, when a range of values is to be presented.

Demand-Based Approach: The demand-based approach is one which describes the number of health professionals needed to care for a given population, as derived from specified assumptions about services demanded and personnel productivity. Calculations may account for changes in technology, health insurance coverage, composition of the population, utilization of allied health personnel, and similar factors.

There are a variety of approaches to estimating health work force requirements which may be characterized as being demand-oriented. Klarman,[6] Lave *et al.*[7] and Applied Management Sciences[8] discuss demand approaches extensively. All conclude that these economic approaches are more realistic estimators of requirements for health personnel than the needs-based approaches. However, given the wide range of methodological approaches included in this category, it is not clear that all demand-based estimates should be viewed as being of higher quality and/or reliability than those produced using alternative approaches. Moreover, it should be recognized that the usefulness of the demand approach to health work force requirements may lead to a variety of estimates, rather than to one uniform standard, applicable to different geographic regions, populations, and income levels.

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[5] See Applied Management Sciences' Report on Approaches for Developing Needs-Based Criteria, Report on Contract No. HRA 232-80-0038, August 1980.

[6] Klarman, H.E. "Economic Aspects of Projecting Requirements for Health Manpower," Journal of Human Resources, (IV, 3), 1969, pp. 360-76.

[7] Lave, J.; Lave, L.B.; and Leinhardt, A. "Medical Manpower Models: Need, Demand and Supply," Inquiry, June 1975, pp. 97-125.

[8] Applied Management Sciences, Review of Health Manpower/Population Requirements Standards, DHEW Publication No. (HRA) 77-22, October 1976.

Three types of demand-based methodologies were investigated for potential usefulness in estimating allied health personnel requirements:

- personnel-to-population approaches;
- utilization approaches; and
- economic models.

Each of these approaches was found to offer advantages and disadvantages. The personnel-to-population ratio approach, for instance, was frequently favored because of its simplicity and the fact that data requirements for this approach are relatively easy to satisfy. Utilization models and economic models, on the other hand, are more flexible and capable of taking into account a variety of influences, particularly when the researcher is interested in projecting future requirements. However, data requirements and methodological considerations cause these latter two approaches to be more difficult to implement. Consequently, the general and specific recommendations in this report focus on the use of personnel-to-population ratios as the basic methodology for estimating requirements for allied health personnel.

Considerations of Data Requirements and Availability

The methodologies described above suggest several groups of variables which may be used in order to estimate requirements for allied health personnel using a personnel-to-population ratio approach.

Data are available on population size and demographic characteristics of the population at the national, state, and county levels. A major source of data for analysis of health professions issues is the Area Resource File (ARF), developed in 1971 by the Bureau of Health Professions, and currently being expanded and refined under contract by Applied Management Sciences. The ARF is a computer-based, county-specific information system with broad analytical capabilities. Since its initiation in 1971, the system's data base has grown significantly, and now contains a wide range of health and socioeconomic information of use for health systems research, analysis, and planning at both national and local levels.

In addition to data on size and demographic characteristics of the population, the successful development of estimates of requirements for allied health personnel is dependent on the availability and reliability of existing data on current and/or past supply of allied health personnel. Whatever approach is adopted, initial estimation of requirements will rely, in part, on an assessment of the current supply relative to some measures of need or demand for services. Consequently, the feasibility of developing methodologies for estimation of requirements must be examined within the context of existing data on supply of allied health personnel.

The study of existing supply data for the 21 allied health occupations which constitute the nine occupational clusters included in this effort has been described in earlier in this chapter. The outcome of this study included recommendations for procedures to improve estimates of supply of allied health personnel. An essential component of this project was the assessment of all identified data sources on supply of allied health personnel.

Review of existing supply data reveals that relatively high quality and consistent data on the total supply of allied health personnel are available only for several of the 21 occupations. Data for other occupations present problems of definition, reliability, or inconsistency in estimations of requirements which rely heavily on utilization of existing data. These problems will be discussed in the separate occupational cluster chapters of this report.

Conduct of Interviews to Obtain Informed Opinions

The conduct of the interview phase of this project was of substantial importance. Consequently, interaction and communication between the Bureau of Health Professions' Project Officer and Applied Management Sciences' project staff was essential during all stages of the development and conduct of this task. In addition, an effort was made to involve the Steering Committee of the Forum on Allied Health Data (FAHD) and staff of the relevant professional associations in the identification and selection of potential interviewees. As a result, the interview list was tentatively prepared and revised several times prior to its finalization in early November 1980. The methodology described below for the selection of interviewees summarizes the final selection method which was the result of discussions and comments received from the Project Officer, other BHPr staff, the Steering Committee of the FAHD, and several FAHD members and professional association staff persons who were interested and volunteered comments and recommendations. The interview list finally prepared is as responsive as possible, given the inherent limitations of the task, to the concerns and goals of all participants. The logistics and conduct of the interviews were also discussed with many of these persons and the concerns expressed influenced, to a great extent, the final structure of the interview process.

Selection of Potential Interviewees: The selection of potential interviewees to be considered for this study was of critical importance to the final outcome of the project. Therefore, it was necessary to identify initially a number of categories within each occupational cluster which could be used to provide a construct for the selection of interviewees. Numerous discussions occurred between the project staff, members of the Steering Committee of the Forum on Allied Health Data, the Project Officer, and other Bureau of Health Professions staff in order to determine which were the appropriate categories for this purpose. There was a significant limitation to the number of categories which could be selected since no more than nine interviews per occupational cluster were to be conducted. However, to the extent possible, project staff was concerned that the nine individuals selected were representative of the population and knowledgeable of the issues within specific occupational clusters.

Within each occupational cluster, the initial stratification was for representation from each of the occupational disciplines represented by that cluster (e.g., medical record administrators and medical record technicians). A second stratification level was developed following discussions with the Project Officer and other Bureau of Health Professions staff. The four categories agreed upon included:

- professional association officers and/or staff;
- academic personnel;
- employers/supervisors; and
- practitioners.

In order to select potential interviewees for the professional association category and for the academic personnel category, the primary methodology for selection was to solicit names of suggested interviewees from members of the professional associations representing each of the occupations within the cluster. Professional educators were sought who were knowledgeable of the field and who had been active in the field for a number of years and were, therefore, likely to be familiar with the major issues and trends within the occupation. An alternative method for identifying members of the academic category was the review of the literature which had been conducted earlier in this study. During the review of the literature, several articles or publications were identified which addressed issues of concern to the current project. When possible, individuals who had conducted these studies or who had published articles indicating that they were familiar with requirements estimation for a specific occupation or discipline were identified and were added to the list of potential academic professionals who might participate in this study. In general, two to three of the nine interviews in each cluster were assigned to the professional association category and two to three were assigned to the academic category. This was not always possible since in some cases, there were several professional associations which, it was felt, should be represented in the interview process. For the most part, no more than five of the interviews conducted represented interviewees who were in these two initial categories.

The selection of the employer/supervisor interviewees and of the practitioner interviewees was conducted using a random selection method. The method used to select individuals for these categories was to randomly select, initially, geographic areas of the country at the county level. Having identified these random counties for a particular occupational cluster, the project staff then initiated telephone calls to, as appropriate, institutions or medical and dental professionals who were located within that county. The institution or the medical or dental practice person who answered the telephone call was briefly informed of the nature of this project and was asked to identify an appropriate participant at that site. In general, those individuals in institutions and practices that were contacted were very cooperative and, as a result, staff was able to fill the list for each occupational cluster with a diverse and representative random selection of professionals. This methodology also ensured that geographic representation was achieved to the extent possible, given the limited number of participants for each occupational cluster.

The result of these efforts was the selection of nine individuals to participate in each of the occupational cluster interviews. For each occupational cluster, two to three of the interviewees selected were assigned to each of the four categories. In addition, geographic representation among the four U.S. Census Regions was also achieved. Although the distribution of interviewees among categories and regions varies by occupational category, the final approved list of interviewees for each occupational cluster is as diverse and representative as possible given the inherent limitations of this approach.

Interview Procedures: A set of interview procedures was developed to ensure the greatest probability of cooperation on the part of the potential interviewees, to elicit as much useful information as was possible, and to ensure accuracy of reporting the interview results. The first stage of the interview task consisted of sending each potential interviewee a letter explaining the purpose of the study, what is expected to be achieved as a result of the study, and the anticipated role of each of the potential interviewees.

Approximately seven days after the mailing of the letters, Applied Management Sciences project staff began contacting, by telephone, each of the potential interviewees who had been mailed letters. Each individual who agreed to participate in the study was asked to set aside a one-hour time period on any day or evening of their choice during which an uninterrupted interview could be conducted.

The project was structured in a way that permitted all interviews within each occupational cluster to be assigned to a specific staff person. This allowed each project staff member to become familiar in advance with the functions, the occupational disciplines, and the issues which might be of significance to the particular occupational cluster. It also ensured that the staff person would be able to synthesize the results of the various interviews and provide a comprehensive overview of the field.

In most cases, the interview was conducted as scheduled. The interviewer proceeded to ask an initial question which had been prepared to open the interview (e.g., "What factors do you think have contributed most to requirements for the services of individuals in your occupation?"). From that point on, the interview was basically unstructured. Most individuals interviewed had definite opinions, had thought about many of the issues that had been raised, and were quite willing to express these opinions and to lead the interview in the direction they felt would be most productive, given the nature of the study. The role of the interviewer was to guide the direction of the discussion to ensure that it remained in areas that were particularly relevant for the project.

The interviews were scheduled to last for approximately one hour. However, project staff persons had been instructed that, if the interviewee was still contributing information and had an interest in proceeding beyond the one-hour period that, within limits, the interview should proceed until the interviewee felt that he or she had contributed all useful information for the study. As a result, the interviews lasted from approximately a minimum of 45 minutes, in some cases, to a maximum of one and a half hours, in other cases.

At the end of each interview, the project staff person explained to the interviewee that a Draft Interview Summary would be prepared which would concisely summarize the information which had been obtained through the interview with that individual. The interviewee was informed that this Draft Interview Summary would be mailed to him or her and that the Interview Summary should be reviewed by the individual for accuracy and for clarity. The interviewee was also asked to consider, at the time he or she reviewed the Draft Interview Summary, if there were any other aspects of the market or occupational cluster that had not been mentioned during the course of the interview. If he or she felt that this was the case, then additional material could be added to the Draft Interview Summary prior to returning it to Applied Management Sciences. It was stressed that any corrections, revisions, or additions to the Draft Interview Summary would be incorporated into the final version of the Interview Summary. These finalized Interview Summaries then provided the basic material from which interview results presented in the chapters on each occupational cluster were constructed.

The information and discussion of the interviews which is provided in each of the occupation-specific chapters in this report draw upon, only, the opinions and the perceptions expressed by individuals who were interviewed for this project. It must be stressed that no attempt was made to verify opinions and perceptions expressed by these individuals and, therefore, the information provided in the occupation-specific chapters should not be accepted as "hard" evidence of the current state of the occupation. The results of the interviews provided useful input into the succeeding stages of the project, especially with respect to the development of recommendations for estimation of future requirements for the allied health disciplines studied. In designing recommendations to improve estimates of requirements for allied health personnel, it is necessary to obtain this type of information directly from members of the occupation so that the requirements estimation methodology takes into account what is actually happening within the field. Researchers outside the occupation frequently do not have the information or the continuity of viewpoint of practitioners and others who have been associated with the discipline for many years. The results of this phase of this project were extremely helpful in providing a framework for the design of recommendations for procedures to improve estimates of requirements for many of the allied health professions which are being studied.

Conduct of Special Research Projects

In addition to the activities described above, the project staff conducted four special research projects which were closely related to issues associated requirements and requirements estimation for the allied health professions. These special research projects were:

- Evaluate estimates of supply from the Allied Health Employment Matrix for the nine allied health clusters. Relate these estimates to the estimates of requirements or needs produced by the activities of this contract.
- Evaluate procedures for determining interaction between trends in the health care sector and specific utilization of and needs for allied health manpower. Evaluate studies and procedures for determining the relationship between practitioner productivity, utilization of allied health manpower, and theoretical needs. Determine specific factors to permit assessment of this relationship.
- Determine procedures for obtaining information on turnover and retention of allied health manpower by discipline. Available turnover and retention data are to be catalogued and analyzed in this process.
- Determine availability of need data on minorities, women, and handicapped in allied health manpower occupations. Determine procedures for improvement of existing minority, women, and handicapped need data.

Results of these investigations provided additional information and perspective upon which the development of recommendations for estimation of current and future allied health personnel requirements.

Considerations for Estimates of Current Requirements and Estimates of Future Requirements

Estimates of requirements for allied health personnel may be used for several purposes. It is anticipated that the primary purposes of estimates generated using the recommendations emerging from this project are:

(1) to estimate current requirements in order to determine whether national shortages or maldistributions exist; and

(2) to project future requirements in order to determine whether future shortages or excess supplies may exist and to develop planning and policy to adjust future supply to more appropriately meet anticipated requirements levels.

The data sources discussed in preceding sections of this chapter are appropriate for estimating current requirements for many of the occupations under study. Estimates of current requirements for allied health personnel rely principally on "what is" and, therefore, utilize current data.

Estimates or projections of future requirements for allied health personnel require the development of assumptions about changes which may occur over time in factors which are expected to influence requirements. Some variables are relatively simple to assess since the federal government has devoted substantial time and effort to projections. Others are more complicated. A brief review of these variables is presented here:

- Population size. The U.S. Bureau of the Census has prepared estimates of population several years into the future, under differing assumptions. Choice of an appropriate set of assumptions is necessary; however, as results of the 1980 decennial census become available, these assumptions may be clarified.

- Demographic characteristics of the population. The Census data mentioned above may be used to project relevant demographic characteristics of the population.

- Health status of the population. This variable is more difficult to estimate for future years since there have been substantial changes in morbidity and mortality in past decades, as well as changes in the distribution of illness among the population. For short-term projections (i.e., ten years or less), it may be acceptable to assume that health status is constant or that changes in health status are subsumed in trends on changes in utilization rates. For long-term projections, it would be useful to acquire informed opinions on the probable nature and direction of changes in health status which might be expected to affect future requirements for allied health personnel services.

- Economic characteristics of the population. Data over time from the Bureau of the Census and the Bureau of Labor Statistics can be used to develop trend estimates of income growth and distributional changes.

Chapter 3
Occupational Therapy

OVERVIEW OF THE PROFESSION

The purpose and definition of the profession of occupational therapy is described by the American Occupational Therapy Association (AOTA) as:

> Occupational therapy is the art and science of directing man's participation in selected tasks to restore, reinforce and enhance performance, facilitate learning of those skills and functions essential for adaptation and productivity, diminish or correct pathology and to promote and maintain health. Its fundamental concern is the development and maintenance of the capacity, throughout the life span, to perform with satisfaction to self and others those tasks and roles essential to productive living and to mastery of self and the environment.[1]

Two levels of credentialed allied health personnel are employed in the occupational therapy discipline. The occupational therapist is trained to evaluate the self-care, work, and play/leisure time performance skills of well and disabled clients of all age ranges; to plan and implement programs, social, and interpersonal activities designed to restore, develop, and/or maintain the client's ability to accomplish satisfactorily those daily living tasks required of his/her specific age and necessary to his/her particular occupational role adjustment.[2]

The occupational therapy assistant works under the supervision of an occupational therapist in planning and implementing programs designed to restore or develop a patient's day-to-day activities following disease or physical injury.

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[1] Essentials of an Accredited Educational Program for the Occupational Therapist, American Occupational Therapy Association, in collaboration with the American Medical Associaton (Washington, D.C.: American Occupational Therapy Association, October, 1972, p.1).

[2] An Approach Toward Development of Allied Health Employment Matrices: Part II--Presentation of Occupations, report prepared for the Bureau of Health Manpower under Contract No. HRA 230-75-0018 (Rockville, MD: Information and Communication Applications, Inc., 1977).

Credentialed occupational therapists and occupational therapy assistants are defined as those individuals who have completed all requirements for certification by AOTA. Although there are other professions which provide services, which in part overlap occupational therapy (e.g., independent living specialists, recreation therapists, art therapists), they are trained to provide only a limited range of the full spectrum of services provided by the registered occupational therapist (OTR) and the certified occupational therapy assistant (COTA). In addition to AOTA's voluntary credentialing program for occupational therapy, 14 states and the District of Columbia have licensure laws. As a rule, the licensing requirements are similar to AOTA's certification requirements. In those states not having licensure laws, there may be nonuniformity of definition; individuals may refer to themselves as occupational therapists though they do not meet the standards required of registered occupational therapists. As a result, there may be differences in the quality of the occupational therapy labor force between those states which require licensure and those which do not.

Occupational therapists are employed in a variety of settings. A summary of the most recent AOTA-member survey was provided in the February 1979 "Data Line," a column in the Occupational Therapy Newspaper. This summary indicates that registered occupational therapists are employed in the following settings:

- hospital - 34 percent;
- school system - 14 percent;
- rehabilitation center - 11 percent;
- skilled nursing facility/ICF - 8 percent;
- university - 6 percent;
- residential care facility - 4 percent
- community mental health center - 4 percent; and
- other - 19 percent.

This survey also indicates that occupational therapists are predominantly (95 percent) female. In addition, a significant number--12 percent--work under contract, rather than in direct employment. The 1977 Member Survey also indicated the presence of a reserve work force, since 16.7 percent of responding members labeled themselves "not employed--plan to work again." A new Member Survey is currently being conducted by AOTA and results will be available in mid-1982.

DEFINITIONAL CONSIDERATIONS

Prior to determining the existing supply or estimating requirements for services provided by occupational therapy professionals, it is essential that a consistent definition of each occupation to be selected. However, for this occupational cluster and the majority of allied health professions, universal agreement on definitions of the population is not present.

Occupational Therapists

The role and functions of the practicing occupational therapist appear to be well defined. The basic educational requirement for certification include graduation from an accredited baccalaureate or post-baccalaureate occupational therapy program and completion of six months of supervised fieldwork. A large subset of the profession obtains certification. Credentialing of occupational therapists is a voluntary process in which graduates of accredited education programs are eligible to take a national certification examination administered by the American Occupational Therapy Association.

Data collection efforts for this occupation have measured both the total supply of occupational therapists and the number of registered occupational therapists. Independent estimates from the Bureau of Labor Statistics and the American Occupational Therapy Association of the supply of employed occupational therapists indicate that approximately 90 percent are currently certified.

There is another category of personnel, variously called aides, attendants, technicians, or assistants. These individuals are not certified, and normally have only on-the-job training, but may sometimes work with patients. Most often they provide clerical assistance or help with equipment maintenance or transporting patients to and from therapy. Many facilities call these individuals occupational therapy assistants, and this confusion in terminology makes it difficult to determine what kind of individuals are providing service to patients, and, therefore, what is the actual size of the manpower pool.

Given the lack of consistency in the educational requirements and functions of the occupational therapy assistant, it is clear that definition of this occupation is a critically necessary first step for this category of personnel. Two alternative definitions could be considered:

(1) "Occupational therapy assistants" may be defined as those who are employed and who are Certified Occupational Therapy Assistants by AOTA standards; or

(2) "Occupational therapy assistants" may be defined as all certified and noncertified personnel who work under the supervision of an occupational therapist in planning and implementing programs to restore or develop a patient's day-to-day activities.

If the latter definition is adopted, it will be important to refine further the definition to ensure that aides, attendants, and technicians are separable from assistants.

Prior to estimating supply and requirements for occupational therapists, it will be necessary to select a definition of the population of occupational therapists. At least two alternatives are apparent:

(1) "Occupational therapists" may be defined as those who are employed and who have completed all requirements for AOTA certification as occupational therapists; or

(2) "Occupational therapists" may be defined as the total supply of persons employed as occupational therapists, certified and noncertified.

For this occupation, the difference between the two definitions is relatively small. Only about ten percent of the work force is not credentialed.

Occupational Therapy Assistants

Occupational therapy assistants are certified, technical level practitioners, who work under the supervision of occupational therapists, assisting in the treatment and rehabilitation of patients and clients. There are 48 post-secondary institutions offering educational programs, approved by the American Occupational Therapy Association (AOTA), for occupational therpay assistants. Forty-three of these programs award associate degrees and eight offer one-year certificate programs. (Several offer both options.) Following graduation from one of these schools, plus completion of a minimum of two months of supervised fieldwork, an indiviudal is eligible to take the national certification examination given by the American Occupational Therapy Association.

SUPPLY OF OCCUPATIONAL THERAPY PROFESSIONALS

Data sources providing information on the supply of occupational therapy professionals were identified and assessed according to the methods previously discussed. Results and recommendations are discussed separately for occupational therapists and occupational therapy assistants.

Occupational Therapist

Data Sources: Six national work force surveys have been conducted over the past decade which include estimates of the total number of occupational therapists in practice or the number of occupational therapists in selected employment settings. The six studies are:

(1) Occupational Employment Statistics Survey (BLS). The survey collects information on occupational therapists with no distinction being made between registered and nonregistered therapists. In addition to providing estimates of the total supply of occupational therapists, the BLS survey provides a breakdown by employment setting.

(2) Member Data Survey (AOTA). The American Occupational Therapy Association provides information on the number of certified occupational therapists on an annual basis. In addition, AOTA periodically conducts a survey of members in which more detailed employment information on thecertified populations is sought. The most recent survey was conducted in 1980; however, the results from that survey were not available at the time that this report was prepared. Estimates are available from the previous member data survey which was conducted in 1977.

(3) National Nursing Home Survey (NCHS-NNHS). This survey sought information on the number of registered and nonregistered occupational therapists employed in nursing homes.

(4) Survey of Hospital Staff (NCHS-SHS). This survey collected information on the number of registered occupational therapists employed in hospitals.

(5) Allied Health Employment Matrix (AHEM). The AHEM project provides estimates of the number of registered and nonregistered occupational therapists for 1976 based on state-level data. Data were available from 25 states with reasonably good geographical representation. However, only seven states provided data on the total number of occupational therapists employed in all settings. The estimates for the remaining states (which included information on at least one major setting) are extrapolated to all settings using one state--Texas--as the sole guide for purposes of extrapolation. Texas reported employment in hospitals, nursing homes, and all other settings. The distribution of employment by setting in Texas is used to extrapolate data reported in 18 of the 25 states that did not provide data on the number employed in all settings to employment in all settings. If the distribution of employment by employment setting in the United States is substantially different than the distributional pattern in Texas, the AHEM estimate may be in error. Hence, on the basis of sampling considerations alone, the AHEM estimate is to be considered less reliable than the estimates from other sources.

(6) Survey of Selected Hospital Manpower (AHA). The AHA survey provides information on the number of registered and nonregistered occupational therapists employed full-time and part-time in community hospitals. A more recent survey of hospital personnel was conducted in 1980; however, the results of this survey are not currently available.

The estimates of the supply of active occupational therapists from each of the six studies are presented in Table 3.1.

Table 3.1. Estimated Supply of Active Occupational Therapists By Employment Setting and Data Source[1]

	Data Source			
Employment Setting	AOTA (1977)	NCHS (1977)	AHEM[3] (1976)	AHA (1973)
Total	13,400		5,800- 5,900	
Nursing and Personal Care Facilities	1,000	1,000 FT[2] 3,000 PT		
Hospitals	4,600	5,600 FT 700 PT		1972 (1788.0 FTE)
All Others	7,800			

[1] BLS estimates do not appear because they were not available for publication at the time that this report was being prepared.

[2] OTRs only.

[3] Full time equivalent (FTE).

Data Assessment: Table 3.2 summarizes the definition of the population, periodicity, and consistency of the estimates for each of the six data collection efforts for occupational therapists. Three of the studies provide estimates for the total number of occupational therapists in all settings. Preliminary, unpublished estimates from BLS are in agreement with the estimates from AOTA when differences in the population surveyed and in the time frame of the studies are taken into account.

With respect to differences in coverage, the American Occupational Therapy Association estimates that out of a total of 17,454 registered occupational therapists, there were 13,400 employed in their profession in the U.S. in 1977. Based on the assumption that individuals who did not take or did not pass the examination are employed at a rate no higher than that of certified occupational therapists, AOTA estimates that there are approximately 1,200-1,500 additional noncertified occupational therapists employed in the U.S. AOTA derives this estimate by using information on the annual number of graduates of accredited schools of occupational therapy and the annual number of individuals who passed the national certification examination.[3] Thus, part of the difference between the BLS estimate of employed registered and nonregistered occupational therapists in 1978 and the AOTA estimate is due to differences in the population that was surveyed.

With respect to time frames, a portion of the difference between the BLS and AOTA estimates is due to growth in employment of occupational therapists from 1977 to 1978. The total number of registered occupational therapists, according to AOTA membership data, increased nine percent over this period, from 17,454 to 19,051. Given the expected annual increase in employment and given the AOTA estimate of 1,200-1,500 nonregistered occupational therapists in practice, the BLS and AOTA estimates are in close agreement.

The Allied Health Employment Matrix estimate of the total supply of occupational therapists, on the other hand, is substantially lower than other estimates of the total supply. As was discussed in an earlier report for this project, [4] there were serious methodological problems in the AHEM estimation procedure for this occupation. The consequences of these deficiencies in the estimation procedure are evident when a comparison of the AHEM estimate is made with the other estimates of the total supply.

Comparison of the estimated distribution of occupational therapists by setting reveals little consistency among these studies. At best, the estimates provide only a rough order of magnitude of the number of

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[3] Applied Management Sciences. Evaluation of Data Procedures and Estimates Derived from Multiple Sources, Interim Report on Contract No. HRA-232-80-0043, October, 1980, pp. 7.1-7.7.

[4] Ibid.

Table 3.2. Consistency of Estimates of Active Occupational Therapists

Data Source	Coverage	Periodicity	Consistency of Estimate
BLS	Registered and Nonregistered Occupational Therapists, Total Setting	Triennial, most recently in 1978	Consistent with AOTA estimate for total supply. Inconsistent with AOTA estimates by employment setting.
AOTA	Registered Occupational Therapists, Total supply and by Total Setting	Periodic, most recently in 1977	Consistent with BLS estimate for total supply. Inconsistent with BLS estimates by employment setting.
NCHS-SHS	Registered and Nonregistered Occupational Therapists in Hospitals	1977	Roughly consistent with AOTA estimate for hospitals. Inconsistent with other estimates for hospitals.
NCHS-NNHS	Registered and Nonregistered Occupational Therapists in Nursing Homes	1977	Roughly consistent with BLS and AOTA estimates for nursing homes.
AHEM	Registered and Nonregistered Occupational Therapists, Total Supply	1976	Inconsistent with other estimates for total supply.
AHA	Registered and Nonregistered Occupational Therapists in Hospitals	1973	Inconsistent with other estimates for total supply.

occupational therapists employed in various settings. For example, both the BLS and AOTA estimates indicate that hospitals are the major employers of occupational therapists. However, the estimated proportions of the total supply of occupational therapists working in hospitals differ markedly. BLS estimates that over one-half of all active occupational therapists are employed in hospitals, whereas AOTA estimates that approximately one-third may be found in this setting.

The nursing home sector estimates also exhibit a wide divergence. The NCHS-NNHS estimate is approximately twice as large as the BLS and AOTA estimates. This difference can be attributed, in part, to the fact that the NCHS-NNHS survey used trained interviewers who made a concerted effort to determine the number of occupational therapists working in nursing homes on a contract basis. The large number of part-time workers identified in the NCHS National Nursing Home Survey is consistent with this explanation. When estimates of full-time workers are compared, the BLS, AOTA, and NCHS-NNHS findings are roughly consistent. However, in general, estimates of the number of occupational therapists by employment setting must be considered unreliable.

In summary, there appear to be adequate and appropriate data available on the current supply of occupational therapists. Either of the alternative definitions of the occupation may be selected with confidence since reliable data on both the total supply of occupational therapists and the supply of Registered Occupational Therapists are available currently and on a continuing basis. However, data on the distribution of occupational therapists by employment setting have not been found to be consistent.

Summary and Recommendations: Occupational therapy is an occupation for which generally well understood definitional alternatives exist and for which relatively high quality continuing data are available to measure the supply of these professionals under each of the definitional alternatives. Consequently, the following specific recommendations for estimation of the supply of occupational therapists are suggested:

Recommendation 1(a): The total supply of Registered Occupational Therapists should be estimated using the continuous, reliable data available from the American Occupational Therapy Association.

Recommendation 1(b): The total supply of occupational therapists, registered and nonregistered, should be estimated using the continuous, reliable data available from the Bureau of Labor Statistics' Occupational Employment Statistics survey.

Recommendation 2: Reliable estimates for the distribution of occupational therapists among different employment settings are not currently available. It is recommended that the BLS and AOTA employment setting estimates be reevaluated when the results of the 1980 Census of Population are made available. As a result of changes in the Standard

Occupational Classification codes, the 1980 census will provide estimates of the total supply of occupational therapists, and by employment setting. The Census results can then be contrasted with the results of the BLS and AOTA surveys to assess the consistency of the employment setting estimates.

Occupational Therapy Assistants

Data Sources: Five of the six studies of the supply and distribution of occupational therapists also provide data on the number of occupational therapy assistants. Only the Bureau of Labor Statistics' Occupational Employment Statistics survey does not report estimates of the number of occupational therapy assistants. The five studies are:

(1) Member Data Survey (AOTA). The American Occupational Therapy Association provides annual estimates of the number of certified occupational therapy assistants. The association also conducts more detailed employment surveys on a periodic basis. The 1977 Member Data Survey was described in the section on occupational therapists. Four thousand forty-four certified occupational therapy assistants were included in the survey, of whom 1,486 responded--a response rate of 37 percent. The representativeness of the respondents may be questioned; however, the magnitude and direction of the nonresponse bias, if present, has not been determined. No attempt has been made by the American Occupational Therapy Association to estimate the number of noncertified assistants who have received on-the-job training and may be active in practice.

(2) National Nursing Home Survey (NCHS-NNHS). The 1977 NCHS-NNHS, conducted by the National Center for Health Statistics, collected information from a sample of nursing homes on the number of certified and noncertified occupational therapy assistants employed on a full-time and part-time basis in nursing homes.

(3) Survey of Hospital Staff (NCHS-SHS). The NCHS-SHS, conducted by the National Center for Health Statistics, collected information on the number of certified and noncertified occupational therapy assistants employed in all federal and nonfederal hospitals on a full-time or part-time basis.

(4) Allied Health Employment Matrix (AHEM). The AHEM project provides estimates of the number of certified occupational therapy assistants based on state-level data acquired from 15 states which represent only 37 percent of the U.S. population. In addition, only six states provided data on the number of occupational therapy assistants employed in all settings. As was the case for occupational therapists, the distribution of employment in Texas was used to extrapolate employment in all settings for the remainder of the states which did not provide data on employment by setting. This manipulation of the data plays a critical role in the estimation process and will lead to a

serious distortion of the AHEM estimate if the Texas employment pattern is not representative of the U.S. distribution of assistants by employment setting. As a result, the AHEM estimate can be considered, on the basis of sampling considerations, to be less reliable than the other estimates reviewed in this report.

(5) Survey of Selected Hospital Manpower (AHA). The American Hospital Association survey was conducted in 1973 and collected information on the number of "occupational therapy assistants and aides," irrespective of credentialing status, employed full-time and part-time in community hospitals. A more recent survey of hospital personnel was conducted in 1980; however, the results of this survey are not currently available.

The estimates of the supply of active occupational therapist assistants from each of the five studies are presented in Table 3.3.

Data Assessment: Due to the differences among data collection efforts in occupational definitions, there are no consistent, reliable estimates of the total supply of occupational therapy assistants, or of the number of assistants by employment setting (Table 3.4). Estimates from the AOTA and AHEM studies of the number of active, certified occupational therapy assistants are close (approximately 3,000), and are roughly consistent with the total number of graduates from accredited occupational therapy assistant educational programs who could be eligible for certification (approximately 5,000 graduates over the 1970-77 time period[5]). However, the two NCHS surveys that were conducted in the nursing home and hospital sectors, and which did not restrict their definition to certified assistants, produced estimates roughly three times larger than the AOTA estimates for those sectors. Estimates of the total supply of certified and noncertified assistants for all settings are not available.

Unfortunately, AOTA is the only study which provides information on the number of occupational therapy assistants in other employment settings; hence, the consistency of the estimates cannot be assessed. The AOTA estimates indicate that the proportion of assistants working in settings other than hospitals and nursing homes is small, but the reliability of the point estimates is weak since the response rate to the AOTA survey was only 37 percent. Sampling error and potential nonresponse bias make these point estimates inadequate for planning purposes.

In summary, there is no consistent definition of an occupational therapy assistant at present. Both the lack of well established educational requirements, and the relatively small percentage of the occupation who obtain certification contribute to the current state of

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[5] American Occupational Therapy Association. Education Data Survey, 1979, Rockville, Maryland, 1979.

Table 3.3. Estimated Supply of Active Occupational Therapy Assistants By Employment Setting and Data Source

	Data Source			
Employment Setting	AOTA (1977)	NCHS (1977)	AHEM[3] (1976)	AHA (1973)
Total	3,100		1,700- 3,700	
Nursing and Personal Care Facilities	800	1,700 FT 1,100 PT		
Hospitals Facilities FTE)	900	2,600 FT 200 PT		1,577 (1,393.5
All Others	1,400			

[1] The AOTA study reports data on the number of certified occupational therapy assistants employed in hospitals. NCHS reports the number of certified and noncertified assistants. AHA reports the number of occupational therapy assistants and aides.

[2] Full time equivalent (FTE), COTAs only.

Table 3.4. Consistency of Estimates of Active Occupational Therapy Assistants

Data Source	Coverage	Periodicity	Consistency of Estimate
AOTA	Certified Occupational Therapy Assistants, Total supply and by Employment Setting	Periodic, most recently in 1977	Roughly consistent with AHEM estimate for total supply of certified personnel.
NCHS-SHS	Certified and Noncertified Occupational Therapy Assistants in Hospitals	1977	Inconsistent with AOTA estimate for hospitals.
NCHS-NNHS	Certified and Noncertified Occupational Therapy Assistants in Nursing Homes	1977	Inconsistent with AOTA estimate for nursing homes.
AHEM	Certified Occupational Therapy Assistants, Total supply	1976	Roughly consistent with AOTA estimates for total supply of certified personnel.
AHA	Certified and Noncertified Occupational Therapy Assistants and Aides in Hospitals	1973	Inconsistent with AOTA and NCHS-SHS estimates for hospitals

uncertainty concerning the total supply of occupational therapy assistants. The first requirement for the production of reliable estimates for this occupation is a standardized definition.

Estimates of the number of occupational therapy assistants are also not available on a continuing basis, although the American Occupational Therapy Association provides annual membership data on the number of certified assistants. In addition, no data source was found that would permit the estimation of the total supply of certified and noncertified assistants in all settings. Surveys of the number of occupational therapy assistants in the hospital sector and nursing home sector have been conducted, but the reliability of the estimates cannot be assessed, and the surveys are not conducted on a periodic basis. In summary, there is no continuous, reliable source of data on either the total supply of occupational therapy assistants or the distribution of assistants by employment setting.

Summary and Recommendations: Although AOTA has established standards for education and certification of occupational therapy assistants, there is apparently no substantive agreement among existing data sources on the function and/or qualifications needed to define occupational therapy assistants for survey purposes. The following recommendations have been developed which would permit improved estimates of supply to be prepared.

Recommendation 1: The total supply of Certified Occupational Therapy Assistants, if desired, may be estimated using AOTA data currently available.

Recommendation 2: The total supply of certified and noncertified occupational therapy assistants cannot be estimated using currently existing data sources. In addition, further data collection efforts or estimation procedures will be of little use until a standard definition of the occupation is established. Therefore, a well constructed role delineation study of the profession is recommended.[6] The role delineation study could consist of the administration of an in-depth questionnaire mailed to a randomly selected sample of occupational therapy support personnel (e.g., attendants, aides, and assistants) employed in selected settings (e.g., hospitals, nursing homes). The survey would attempt to elicit detailed information on:

- job activities;
- job responsibilities;
- job title;
- educational background;
- credential status; and
- occupational training,

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[6] The AOTA has conducted a role delineation study for credentialed personnel, however, no similar data exist for noncertified persons.

in order to construct a profile of the different categories of employees working within the profession. The survey questionnaire could be developed as a cooperative venture with participants drawn from the relevant professional associations (e.g., AOTA), employer associations (e.g, AHA), educators in the field of occupational therapy, and federal agencies that deal with health work force issues. The results of such a study can be used to establish criteria for defining the population for which information is sought (i.e., occupational therapy assistants).

Recommendation (3): If a well defined occupational category can be constructed, the final recommendation would be to include the category in ongoing data collection efforts that currently provide continuous, reliable estimates for other allied health occupations (e.g., the Bureau of Labor Statistics' Occupational Employment Statistics survey or the Census Bureau's Census of Population or Current Population Survey).

It must be stressed that current estimates of the total supply of occupational therapy assistants should be viewed as of low reliability for planning or other purposes. The uncertain quality of the current data available and the relative newness of the profession suggest that existing data sources do not incorporate sufficient knowledge of this market to produce reliable results.

REQUIREMENTS FOR OCCUPATIONAL THERAPY PROFESSIONALS

The derivation of appropriate criteria to indicate requirements for occupational therapy professionals was conducted in several parts: (1) interviews with knowledgable professionals to identify factors associated with current and future requirements for occupational therapy services; (2) evaluation of the consistency and availability of data on supply of each profession; (3) development of recommendations for estimating current and future requirements for occupational therapy professionals; and (4) construction of personnel-to-population ratios for each profession, using the most reliable data available.

Interviews With Occupational Therapy Professionals

A full description of the purpose, structure, and methodology used for the interviews has been provided in Chapter 2. In this section, a description of the selected interviewees, a summary of results, and a discussion of implications are presented.

Description of Interviewees: Within the limitations implicit in the restriction to nine interviews per occupational cluster, an effort was made to select individuals who represent diverse viewpoints and geographic areas.

Four of the individuals interviewed are associated with the American Occupational Therapy Association--two holding elective offices within AOTA and two members of the permanent professional staff at AOTA's headquarters in Rockville, Maryland. Of these individuals, three are registered occupational therapists with considerable professional experience as practitioners prior to holding their current positions. As a result, these individuals were able to provide, in addition to a broad national perspective, specific experiential opinions from their viewpoints as practitioners and supervisors. One interviewee who is on AOTA's staff has, in addition, substantial experience with professional education for occupational therapy. Another interviewee, not on AOTA's staff, is the Chair, Department of Occupational Therapy, of a large program in the Southwestern United States. Discussions with these two individuals provided an overview of educational and initial job placement activities in the profession.

Four individuals were selected randomly to be interviewed. These individuals represent employers, supervisors, and practitioners in the profession. One interviewee in this category is a manager for a large national temporary employment agency which provides occupational therapy (and other services) through Home Health Agencies. Two of these selected individuals are supervisor-practitioners. One directs a department in a 500-bed hospital with four full-time OTRs; the other directs a staff of six OTRs and one COTA. Finally, one indiviudal was selected to be interviewed who is not an OTR but who fills an occupational therapy position in a small mental health unit of a hospital.

An effort has also been made to choose interviewees to ensure geographic diversity of the perspectives provided. As a result, interviewees are distributed among all four Census Regions and eight states. Table 3.5 illustrates the major categories represented among the nine interviewees in the occupational therapy cluster.

The interviewees have experience in the profession of occupational therapy ranging from two and one-half years to over 20 years. The OTRs in the group have been employed in a variety of settings: (1) mental health units; (2) acute care hospitals; (3) rehabilitation hospitals; (4) home health agencies; (5) academia; and (6) outpatient rehabilitation centers. The various backgrounds of the participants ensure that a broad range of viewpoints is presented.

Table 3.5. Matrix of Characteristics of Occupational Therapy Cluster Interviewees

	GEOGRAPHIC REGION			
CATEGORY	NORTHEAST	NORTH CENTRAL	SOUTH	WEST
Association		X	XX	
Academic			X	X
Employer/Supervisor	X	XX		
Practitioner	X			

Results: The major theme emerging from the nine interviews conducted is that a shortage of occupational therapy services exists, relative to requirements. The evidence cited in support of this position included such indicators as:

- positions available to OTRs and COTAs exceed the available number of job seekers and substantial numbers of unfilled vacancies in rural areas and in some urban areas reported by state occupational therapy associations;
- advertisement of positions in professional publications has doubled to tripled in the past few years;
- rapid increases in starting salaries offered to OTRs; and
- projections by the Bureau of Labor Statistics suggesting that occupational therapy is expected to be one of the 10 fastest growing occupations over the next decade with over 2,500 new positions per year while the current educational system is capable of producing only 1,700 new graduates per year.

The shortage of faculty members available to expand the number and size of occupational therapy training programs was also mentioned by several participants. This constraint makes increasing the supply of OTRs and COTAs, at a more rapid rate, difficult. On the other hand, it was conceded by those interviewees with knowledge of the academic area that the applicant pool, from which occupational therapy programs draw their students, is declining. This decline is occurring because of the decreasing number of college-age persons, overall, and perhaps may be associated with the changing career goals of many young women. Whatever the underlying reasons, the declining applicant pool suggests that it may be difficult to increase the supply of occupational therapy services without a decrease in the average quality of program graduates.

Another factor which has been cited as indicative of the shortage of occupational therapy services is the development of several new professions which are oriented toward provision of one or more aspects of traditional occupational therapy services. These professions (e.g., art therapy, recreation therapy, independent living specialists) are most likely to be employed in nonacute care settings, it was suggested. The growth in these professions may be interpreted as being the result of the shortage of COTAs and OTRs.

Factors Affecting Needs-Based Estimates. It was generally agreed by all individuals interviewed that there is a greater need for occupational therapy services than is currently being met. However, no needs-based estimates of requirements for occupational therapy services have been performed on a national level.

Two major factors were mentioned which have had a positive effect on the need for occupational therapy services:

(1) The shift toward deinstitutionalization and "mainstreaming" of the handicapped has increased the need for occupational therapy services. In the past, the severely handicapped were institutionalized and little effort was made to develop the maximum functioning levels for these persons. Today, to the extent possible, the handicapped are being aided to lead an independent and normal existence. Occupational therapists have an important role to play in assisting the handicapped to function as fully as possible in society.

(2) The number of elderly persons in the population is increasing rapidly. The elderly frequently suffer from illnesses and chronic disabilities which restrict activity and can be alleviated or overcome with treatment and assistance from occupational therapy professionals.

The growth in these two groups is expected to account for a major portion of the increasing need for occupational therapy services.

One participant suggested that occupational therapy services may be expanded to provide services in prevention and stress management. The need for these services may be expected to be substantial and, potentially, to grow in the future.

It was suggested by two participants that there is a need for continued and increased research on clinical output in occupational therapy. Measurement of output and assessment of benefits of occupational therapy services may be an important issue to the future of the profession.

Although not specifically mentioned by any of the indiviudals interviewed, the analysis of the existing and projected need for occupational therapy services, on either an optimal or a minimum need assumption, would provide essential information on the current state of this profession.

Factors Affecting Demand-Based Estimates. All interviewees stated that legislation had had the most significant impact on demand for occupational therapy services in the past decade. Of greatest importance, most participants said, has been the passage of P.L. 94-142 which requires that services be provided to handicapped children through the public school system. As a result, the demand for occupational therapists to work in public school settings has increased substantially.

Another factor which has significantly affected demand for services is the increasing prevalance of third-party reimbursement for services. Private health insurance coverage for this service has grown for both inpatient and outpatient provision, several interviewees stated. Medicare has for some time allowed reimbursement for occupational therapy services provided in inpatient settings. Recently, as was mentioned above, Medicare reimbursement for occupational therapy services has been expanded to include services provided in freestanding outpatient settings and through home health agencies. It is anticipated that this expansion of coverage will increase demand for services.

Awareness of the need for and benefits of occupational therapy services was also mentioned by several interview participants as a consideration affecting demand for occupational therapy services. The American Occupational Therapy Association is conducting a campaign to increase public awareness of the benefits of occupational therapy. Two practitioners mentioned that increasing physicians' awareness of the services offered also has the effect of increasing demand for services. One interviewee said that the education of insurance purchasers and sellers about the need for an occupational therapy benefit in insurance policies will lead to increased reimbursement for occupational therapy services. There was generally agreement among the participants that awareness of consumers, physicians, and insurers/insurance negotiators will lead to an increasing demand for occupational therapy services.

On the other hand, there was some concern expressed by several participants that the emphasis on cost containment in the health care system will lead to, at least, a reduction in the rate of increase in demand for occupational therapy services.

Other Considerations. Several other factors were mentioned by interviewees which could affect requirements estimation for this profession.

There was generally agreement among all interviewees that a maldistribution of occupational therapy services exists. A few areas (e.g., Denver) were suggested as having an adequate supply of occupational therapy services. Rural areas and some urban areas (e.g., St. Louis) were said to have an inadequate supply of services. Estimates of requirements for occupational therapy services at the national level would not take into consideration maldistribution of services. However, it seems clear that, eventually, attention should be directed to this problem.

Several participants mentioned that they expect that there has been a shift in the distribution of occupational therapy services by employment setting. Although results of the 1981 AOTA Member Survey are not yet available, the expectation is that there will have been a substantial increase in the number of AOTA members employed in public school settings. Similarly, an increase in employment of occupational therapists in home health agencies and in outpatient settings is expected, said several participants. A decrease in positions for occupational therapy professionals in hospitals is anticipated by some interviewees--due to rapidly rising costs of inpatient care and the emphasis on minimizing hospitalization to the extent possible. These changes in settings in which occupational therapy services are provided should be taken into account in developing estimates of requirements for services.

Another consideration relevant to estimates of requirements for occupational therapy services is the definition of the groups of individuals who are currently providing these services. Clearly, there is agreement that OTRs and COTAs provide occupational therapy services. Two interviewees suggested that the role of the OTR may become more constrained to program planning and evaluation, due to the shortage of OTRs. COTAs would, in general, become the group with major responsibility for application of modalities. An AOTA study of Role Delineation for OTRs and COTAs within AOTA was completed in 1981. Another Task Group on Entry Level Qualifications for each professional level has also recently completed its work. Decisions of these two groups may have an impact on future projections of the mix of personnel necessary to meet projected requirements for occupational therapy services.

A similar consideration is the emergence of new professions which perform one or another of the functions of traditional occupational therapy. Examination of the number, distribution among settings, and tasks performed by these specialists should be performed prior to completing any analysis of current or future requirements for occupational therapy services.

Summary and Implications of Interview Results: Results of the interviews provided information on the factors affecting current and future requirements for occupational therapy services from the perspective of professionals who are actively involved with the issues of occupational therapy practice and provision. A summary of the major findings from these interviews is provided in Table 3.6. These results are, it must be stressed, based upon the perceptions and observations of the nine persons selected to be interviewed. However, the general agreement of the participants on major issues increases the degree of confidence with which one can view these findings.

There is a need for more quantitative and analytical examination of the field of occupational therapy to provide information necessary to generate accurate estimation of requirements for services. Of particular usefulness would be studies of medically indicated need for occupational therapy services by a population. A study oriented toward calculation of total need and another study of need based upon some restrictive assumptions of costs and expected benefits of services provision would provide a framework for estimation of requirements for occupational therapy services.

Another issue of some importance is that of the division of labor within the field. Estimates of requirements for providers of occupational therapy services will vary depending upon how roles are defined and which groups are included within the definition of "providers." No studies addressing these issues have been identified through this and earlier phases of the study.

The interviews were conducted to obtain information on the structure and characteristics of the occupational therapy services market. Estimation of requirements for personnel to provide these services, however, requires that attention be directed separately at each of the occupations under study, and that distinct recommendations be developed for each occupation.

Table 3.6. Summary of Major Findings from Interviews with Occupational Therapy Professionals

ISSUE		FINDINGS
Overview	o	A national shortage exists of occupational therapy professionals.
	o	Requirements for occupational therapy professionals are expected to grow faster than supply for the next decade.
Need Factors	o	Increasing numbers of handicapped children and adults need services to function outside institutions.
	o	Increasing numbers of elderly persons with chronic disabilities need services.
	o	Prevention and stress management activities may be needed as this professional area develops.
Demand Factors	o	Legislation of demand-increasing and/or demand-constraining nature affects demand.
	o	Increasing third-party reimbursement for services provided in a variety of settings will affect demand.
	o	Increasing awareness of consumers, physicians, and insurers of occupational therapy services will affect demand for services.
Other Factors	o	A maldistribution of occupational therapy services exists.
	o	A significant shift in the distribution of occupational therapy providers among alternative employment settings may be occurring.
	o	Definition of what groups constitute the occupational therapy work force and clear guidelines for role delineation are necessary.

Recommendations for Estimating Requirements for Occupational Therapy Personnel

Occupational Therapists

As was discussed earlier, there appear to be adequate and appropriate data available on the current supply of occupational therapists. Either of the alternative definitions of the occupation may be selected since reliable data on both the total supply of occupational therapists and the supply of Registered Occupational Therapists are available currently and on a continuing basis.

Estimating Current Requirements for Occupational Therapists: The general recommendation proposed in Chapter 2 of this report is that a personnel-to-population ratio approach be used to establish current requirements estimates. The review of definitional considerations and of data availability for occupational therapists suggests that this is a feasible recommendation for this occupation. Consequently, the following specific recommendations for estimation of current requirements for occupational therapists are suggested:

> Recommendation 1: State-level occupational therapist-to-population ratios should be constructed using data from AOTA or from BLS, after the definition of occupational therapist to be used has been selected.

Recommendation 2: Determination of a standard of adequacy for the occupational therapist-to-population ratio should be made. A national mean or a state median value may be appropriate. Information acquired through interviews with persons knowledgeable in the field of occupational therapy suggests that currently a national shortage of occupational therapists exists. Consequently, since use of a national average would incorporate existing shortages into the requirements estimate, it is recommended that determination of the standard of adequacy take into account any existing evidence on the presence of a current shortage (e.g. number of job vacancies, rate of increase in salary levels).

Recommendation 3: Use of the occupational therapist-to-population ratio standard of adequacy to assess whether subnational geographic regions have sufficient occupational therapists to meet existing requirements should take into account characteristics of the subnational region in determining whether an excess or shortage of occupational therapists exists. Specifically, consideration should be given to the presence of employment settings in which occupational therapists may be employed (e.g. hospitals, nursing homes, rehabilitation centers) and state licensure requirements.

Estimating Future Requirements for Occupational Therapists: The occupational therapist-to-population ratio and the standard of adequacy selected to estimate current requirements for occupational therapists will provide the basis for estimation of future requirements for occupational therapists.

One alternative approach to estimating future requirements is to assume that the occupational therapist-to-population ratio standard of adequacy represents the minimum level of future requirements. Therefore, projected increases in the population require that proportional increases in the numerator of the ratio occur. This approach has the advantage of simplicity but fails to take into account factors other than population growth which may be expected to affect requirements for occupational therapists in the future.

Interviews with individuals knowledgeable of the occupational therapy field focused, to a great extent, on factors which are expected to affect requirements for occupational therapists in the future. A summary of the more relevant of the findings from these interviews has been provided in Table 3.6. Review of this information has resulted in the development of the following recommendations for determining future requirements for occupational therapists:

Recommendation 4: The standard of adequacy of the occupational therapist-to-population ratio selected for the estimation of current requirements for occupational therapists should be used as the foundation for the development of estimates of future requirements for occupational therapists. Projections of future population size from the U. S. Bureau of the Census can be used to establish the denominator of the future ratio and the numerator (i.e. required number of occupational therapists to provide a constant level of services to the future population) can then be constructed.

Recommendation 5: Refinement of the estimate of future requirements for occupational therapists should take into account the factors indicated in Table 3.6, to the extent possible. While the direction of the effects of such factors on requirements may be clear, the magnitude of the impacts have not been determined. Consequently, it is recommended that professional opinions be sought prior to attempting to refine the ratio to permit adjusted future requirements to be calculated.

The importance of many factors, including population change, on future requirements is directly a function of the time interval over which future requirements are to be estimated. An estimate of requirements for occupational therapists in 1982 may require only minor adjustments from the current estimate due to changes in population. An estimate of requirements for occupational therapists in the year 1999, on the other hand, must take into consideration a variety of factors including anticipated technological change, legislative trends, shifts in the age composition of the population, etc. The input of expert opinion to the latter estimate would be crucial; for the former estimate, expert opinion may be unnecessary. In all cases, it is clear that estimate of future requirements demands that judgmental decisions be made.

Occupational Therapy Assistants

Review of available data sources on the supply of occupational therapy assistants revealed that, due to differences in occupational definitions among data collection efforts, there are no consistent, reliable estimates of the total supply of occupational therapy assistants or of the number of assistants by employment setting. Therefore, it is clear that definition of this profession is a critically necessary step to be taken prior to attempting to estimate requirements.

Estimating Current Requirements For Occupational Therapy Assistants: The following specific recommendations for estimation of requirements for occupational therapy assistants are provided:

Recommendation 1(a): If a definition of occupational therapy assistants is selected which restricts the occupation to include only COTAs, then it is recommended that AOTA data be used to construct an occupational therapy assistant-to-population ratio for use in assessing requirements for occupational therapy assistants.

Recommendation 1(b): If a definition of occupational therapy assistants is adopted which includes certified and noncertified occupational therapy assistants, then it will be necessary to create the data necessary to construct an occupational therapy assistant-to-population ratio. No data are currently available on the total supply of certified and noncertified occupational therapy assistants. Consequently, the choice of this definitional alternative implies that only very rough approximations of requirements for occupational therapy assistants can be calculated using a personnel-to-population ratio.

Recommendation 2(a): If a Certified Occupational Therapy Assistant (COTA) definition is selected, then state-level COTA-to-population ratios should be calculated using AOTA data. A standard of adequacy can be determined on the basis of a national mean, state-level median, or professional opinion. As was suggested for occupational therapists, consideration should be given to the presence of existing conditions which may signify a shortage of COTAs when determining the standard of adequacy.

Recommendation 2(b): If both certified and noncertified persons are to be included in the professional definition, then it is recommended that a national mean occupational therapy assistant-to-population ratio be used as the standard of adequacy. The existing data are uncertain as to reliability and refinement of the national average will be correspondingly uncertain as to reliability.

Recommendation 3: To the extent that the determined standard of adequacy of the occupational therapy assistant-to-population ratio is to be used to assess adequacy of occupational therapy assistant services at a subnational geographic regional level, consideration should be given to specific conditions in the subnational area which may affect requirements for occupational therapy assistants. Of particular concern should be such factors as the apparent adequacy of the supply of occupational therapists and the number and size of potential employment settings. Informed opinion may provide useful input to assessments of this type.

Overall, it should be recognized that estimating requirements for occupational therapy assistants will be an imprecise exercise at best. The occupation is relatively new and not well defined--except for COTA requirements. There are only a relatively small number of occupational therapy assistants currently practicing and the use of these providers may not yet be fully developed and understood. In addition, current data availability and quality are limited. Thus, these estimates, if developed, should be used with great caution.

Estimating Future Requirements For Occupational Therapy Assistants: The choice of a standard of adequacy for the current occupational therapy assistant-to-population ratio can provide a basis for estimation of future requirements for occupational therapy assistants. As was discussed above, interviews with persons knowledgeable of the field of occupational therapy have produced information on factors which should be taken into account in estimating future requirements for this occupation (Table 3.6). Thus, the following specific recommendations are offered for estimation of future requirements for occupational therapy assistants:

> Recommendation 4: The standard of adequacy of the occupational therapy assistant-to-population ratio selected for the estimation of current requirements should be used as the basis for development of estimates of future requirements. Projections of future population size from the U.S. Bureau of the Census can be used to establish the denominator of the future ratio and the numerator (i.e. the required number of occupational therapy assistants to provide a constant level of services to the future population) can then be constructed.
>
> Recommendation 5: Estimation of future requirements for occupational therapy assistants should be closely coordinated with estimation of future requirements for occupational therapists. Since the factors cited in table 6 affect requirements for occupational therapy services provided by both occupational therapists and assistants, similar assumptions and methodologies should be used for both calculations. Professional opinion should be sought on the issues of complementarity and substitutability between the two occupations, in addition to those factors discussed for the occupational therapist estimates.

It must be stressed that estimates of future requirements for occupational therapy assistants should be viewed as of low reliability for planning or other purposes. The uncertain quality of the current data available and the relative newness of the occupation suggest that projections into the future may not incorporate sufficient knowledge of this market to produce reliable results. Consequently, short-term estimates of future requirements may be of some potential usefulness but long-term projections may be expected to be of low probability of accuracy.

Personnel-to-Population Ratios

It has been recommended in this report that personnel-to-population ratios be used as the basic methodology for estimating current and future requirements for occupational therapists and for occupational therapy assistants. Considerable judgment is required to determine the appropriate personnel-to-population ratio standard by which to assess adequacy of the current supply or to be used in developing policy which will affect future supply. However, the current personnel-to-population ratio can be used as a foundation upon which to apply these judgments.

During this project, data sources have been identified which provide estimates of the total and state-level supply of registered occupational therapists and certified occupational therapist assistants. Therefore, OTR-to-100,000 population ratios and COTA-to-100,000 population ratios have been calculated and are presented in Tables 3.7, 3.8, and 3.9. It is emphasized, however, that these estimates are only for the registered population in each occupation. While this is not a severe problem for occupational therapists, the estimates for occupational therapy assistants may substantially understate total requirements for certified and noncertified personnel to provide services.

Table 3.7. National Personnel-to-100,000 Population Ratio, Occupational Therapy Professions, 1980

Occupation	Total Supply	Personnel-to-100,000 Population
Registered Occupational Therapists (1980)	22,150	9.82
Certified Occupational Therapy Assistants (1980)	5,460	2.48

SOURCES: (1) American Occupational Therapy Association Membership Files.
(2) U.S. Bureau of the Census.

Table 3.8. Registered Occupational Therapists-to-100,000 Population, by State, 1980

State	Number of Registered Occupational Therapists	Personnel-to-100,000 Population[2/]
Alabama	140	3.59
Alaska	50	12.48
Arizona	250	9.19
Arkansas	80	3.50
California	3,100	13.09
Colorado	650	22.49
Connecticut	380	12.22
Delaware	50	8.39
District of Columbia	80	12.54
Florida	610	6.26
Georgia	250	4.57
Hawaii	180	18.65
Idaho	50	5.29
Illinois	1,000	8.75
Indiana	400	7.28
Iowa	200	6.86
Kansas	340	14.39
Kentucky	100	2.73
Louisiana	190	4.52
Maine	140	12.45
Maryland	460	10.90
Massachusetts	1,140	19.87
Michigan	1,400	15.18
Minnesota	860	21.09
Mississippi	40	1.58
Missouri	460	9.35
Montana	50	6.35
Nebraska	80	5.10

Table 3.8. (Continued)

State	Number of Registered Occupational Therapists	Personnel-to-100,000 Population
Nevada	60	7.51
New Hampshire	200	21.72
New Jersey	580	7.87
New Mexico	100	7.69
New York	1,970	11.21
North Carolina	250	4.25
North Dakota	100	15.31
Ohio	770	7.12
Oklahoma	140	4.63
Oregon	270	10.25
Pennsylvania	920	7.74
Rhode Island	80	8.44
South Carolina	110	3.52
South Dakota	40	5.79
Tennessee	120	2.61
Texas	1,020	7.16
Utah	70	4.79
Vermont	60	11.73
Virginia	530	9.91
Washington	730	17.67
West Virginia	30	1.53
Wisconsin	1,140	24.22
Wyoming	50	10.62

SOURCES: (1) American Occupational Therapy Association Membership Files, 1980, Active Members.

(2) U.S. Bureau of the Census, 1980 Census of Population.

Table 3.9. Certified Occupational Therapy Assistants-to-100,000 Population, by State, 1980

State	Number of Certified Occupational Therapy Assistants	Personnel-to-100,000 Population
Alabama	40	1.05
Alaska	*	*
Arizona	30	1.21
Arkansas	10	.45
California	370	1.63
Colorado	50	1.80
Connecticut	110	3.52
Delaware	*	*
District of Columbia	*	*
Florida	100	1.12
Georgia	10	.19
Hawaii	40	4.37
Idaho	10	1.10
Illinois	270	2.40
Indiana	80	1.48
Iowa	90	3.10
Kansas	40	1.68
Kentucky	10	.27
Louisiana	10	.25
Maine	20	1.81
Maryland	130	3.13
Massachusetts	300	5.19
Michigan	190	2.06
Minnesota	610	15.02
Mississippi	10	.41
Missouri	30	.61
Montana	10	1.27
Nebraska	10	.63
Nevada	*	*

Table 3.9. (Continued)

State	Number of Certified Occupational Therapy Assistants	Personnel-to-100,000 Population
New Hampshire	80	9.01
New Jersey	100	1.35
New Mexico	10	.80
New York	800	4.53
North Carolina	20	.35
North Dakota	70	10.65
Ohio	240	2.23
Oklahoma	30	1.03
Oregon	90	3.55
Pennsylvania	350	2.98
Rhode Island	10	1.07
South Carolina	20	.67
South Dakota	20	2.90
Tennessee	70	1.60
Texas	250	1.86
Utah	*	*
Vermont	10	2.03
Virginia	50	.96
Washington	130	3.31
West Virginia	10	.53
Wisconsin	500	10.58
Wyoming	10	2.22

SOURCES: (1) American Occupational Therapy Assocation Membership Files, 1980.

(2) U.S. Bureau of the Census.

*Fewer than 5 persons.

- Insurance and price levels. Data on trends in insurance coverage of the population for physician services, hospital services, and dental services have been compiled and are readily available. However, these data must be interpreted to determine the linkage between insurance and requirements for allied health personnel. Hospital-based allied health workers, for example, may be presumed to provide insured services under hospital coverage. Other occupations (e.g., speech-language pathologists) may provide insured services only in some employment settings. The degree and impact of changes in insurance coverage must be carefully assessed for each profession. This assessment should include both private voluntary insurance and governmental programs. Price of services may also affect requirements for services of allied health workers. If prices rise more rapidly than insurance coverage, requirements may increase slowly. Although little information is available currently on price of services or on trends in salaries of allied health workers, projections of future requirements should, ideally, take these factors into consideration. The use of informed opinion to develop assumptions about these factors may be the best alternative.

- Utilization rates. Current utilization rates of allied health services provide a base point for projecting future requirements for allied health personnel. Few data are available on utilization of allied health services by demographic characteristics of the population, however. To some extent, these projections of utilization patterns can be derived by examining physician, hospital, and dental services utilization patterns and trends. Some assumptions about relationships between existing utilization data and utilization of allied health personnel may be developed.

The acquisition of informed opinions from knowledgeable persons from each of the occupational clusters during earlier stages of the current effort, as discussed in the preceding sections, provided a foundation for the development of assumptions for estimation of future requirements for allied health personnel.

General Recommendations for Procedures to Improve Estimations of Requirements for Allied Health Personnel

Development of recommendations for procedures for improvement of estimates of requirements for allied health personnel utilized the significant findings from each of the prior stages of the project which have been identified and briefly discussed in this chapter. As a result of this comprehensive assessment of the current state-of- the-art in estimation of requirements for allied health personnel and the review of data availability, a number of general recommendations for procedures to improve estimates of requirements for allied health personnel have been developed. These general recommendations are:

Recommendation 1: A personnel-to-population ratio approach should be used as the fundamental methodological approach to estimating requirements for allied health personnel. The existing state-of-the-art and current data availability necessitate this recommendation. For some occupations, refinements of the personnel-to-population ratio to account for selected factors influencing requirements may be feasible. However, the simple personnel-to-population ratio approach may be the maximum level of sophistication possible for most of the occupations under study.

Recommendation 2: A standard of adequacy of requirements for allied health personnel should be determined. To the extent possible, the national, regional, and/or state mean and median levels of personnel-to-population ratios should be examined and/or informed opinion sought to determine the appropriate level of the ratio to meet existing or projected requirements. Reliance on "what is" may result in adoption of a standard which incorporates existing shortages, excesses, or maldistributions. Consequently, prior to establishing a standard of adequacy, such factors as existing job vacancies, and rates of salary increases relative to other occupations should be considered.

Recommendation 3: To the extent possible, the estimation of requirements for allied health personnel should also take into account such factors as the distribution of potential employers and employment settings, degree of substitutability and complementarity among related occupations, and variations in licensure requirements and restrictions. For example, if dental hygienists are required to perform work only under direct supervision of a dentist, then an area with no dentists must be defined as an area with no independent requirements for dental hygienists. Similarly, if a medical record administrator or a medical record technician is equally qualified to provide services for a 100-bed hospital, then assessment of requirements for these professions must be performed simultaneously. Finally, if some states restrict the role of allied health professionals, then these limitations must also be taken into account. Other factors may also need to be accounted for in considering specific occupations. It must be stressed that a national mean or median personnel-to-population ratio should not be used to assess the adequacy of the supply of allied health personnel in smaller geographic regions without consideration of these and other relevant factors.

Recommendation 4: Estimates of current and future requirements for allied health personnel should be based upon clearly stated definitions of the occupation under consideration.

Recommendation 5: Estimates of future requirements for allied health personnel should take into account informed opinion on trends, technology, practice patterns, and similar factors. The results of the interview phase of the current study provide substantial information which can be used as a foundation for estimates of requirements. This input is especially critical for estimates of future requirements which must rely on professional knowledge of likely changes in practice or delivery to adequately project requirements.

These five general recommendations are proposed as the basic methodological framework for estimation of requirements for allied health personnel. Each of the occupational clusters included in the current project, and each occupation within the clusters, presents specific characteristics and problems which must be addressed. In subsequent chapters of this report, each occupational cluster is examined and specific recommendations are presented which will enable development of estimates of requirements for each of the 21 separate occupations under study.

Calculations of Personnel-to-Population Ratios for Each Occupation

The final phase of this study is the calculation of personnel-to-population ratios for each occupation for which a reliable source of data on supply has been identified. For each occupation, if possible, the following calculations are performed:

(1) a national personnel-to-100,000 population ratio is calculated; and

(2) individual state personnel-to-100,000 population ratios are calculated.

Due to the fact that there are several professions with relatively few members, it was decided to develop the estimates on a "per 100,000 population" basis to produce whole number or large fractional estimates. For each occupation for which personnel-to-population ratios are calculated, data sources for both the numerator and the denominator are identified fully.

There are several occupations for which no personnel-to-population ratios have been estimated. The reasons for these omissions are that no reliable, consistent data sources have been identified which can be used for the numerator of the ratio. The reasons for the omission of any occupation are discussed in the appropriate occupation-specific chapters.

Chapter 4
Speech-Language and Hearing

OVERVIEW OF THE PROFESSION

Speech-language and hearing services are provided by two related professions: (1) speech-language pathology; and (2) audiology. Certification in both professions requires a graduate degree, clinical experience, and qualifying on a national examination.

The definition of speech-language pathology used in this study describes those who specialize in the diagnosis and treatment of speech and language disorders, such as neurological disturbances, defective articulation, or foreign dialect in children and/or adults. Such diagnosis and treatment includes assessment of speech and language skills as they relate to educational, medical, social, vocational, and psychological factors. The field of speech-language pathology, however, branches into several different areas of responsibility, as described in A Report on Allied Health Personnel. For example:

> Counseling and guidance are provided by the speech-language pathologist to handicapped individuals and their families. The speech-language pathologist may also work closely with a health care team, as in the care of the aphasic stroke patient, and may provide consulting to educational, medical, and other professional groups. They may teach scientific principles of human communication in educational institutions, direct scientific projects or conduct research in the areas of voice, speech, and language.[1]

Audiology is an occupation which is primarily concerned with an individual's perceptions and comprehension of sound, especially speech and language. The definition of audiology used in this report is:[2]

> The disciplines of audiology focus on disorders in the reception and perception of speech and language. In clinical practice, the audiologist identifies individuals who have such disorders

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[1] A Report on Allied Health Personnel. DHEW Publication No. (HRA) 80-28, Nov. 1979, p. XIV-1.

[2] Applied Management Sciences, Geographic Distribution of Health Manpower Types Not Covered by Current Shortage Area Criteria, Volume II, Final Report. Contract No. (HRA) 232-79-0025, June, 1980.

and determines the etiology, history, and severity of specific disorders through interviews and special tests. These health professionals plan and facilitate optimal treatment through remedial procedures, counseling, and guidance. They may also make appropriate referrals for medical or other professional attention.

In addition to this, audiologists determine the range, nature, and degree of hearing function related to the patient's communication needs whether it be an organic or inorganic hearing disability. They also have the capabilities required for counseling, guidance, auditory training, speech reading, speech conversation, research in the areas of physiology, pathology, biophysics, and psychophysics of auditory systems, and act as consultants to various educational, medical, and other professional groups. Audiologists constitute approximately 18 percent of the total number of American Speech-Language-Hearing Association (ASHA) certified speech-language and hearing professionals.

The basic occupational preparation for this field is graduation from an accredited master's degree program in speech-language pathology and/or audiology; however, school systems will often employ individuals with training only at the baccalaureate level. Although the American Speech-Language-Hearing Association certifies speech-language pathologists and audiologists who have the qualifications stated above, an estimated 55-60 percent of the noncredentialed individuals are baccalaureate-level speech and hearing professionals who are employed in public school settings.[3/]

Concern has been expressed by several educators, professional association staff members, and practitioners in this field about the number of states that permit baccalaureate professionals to practice in the public schools.[4/] However, many states regard speech professionals who provide services in public school settings as teachers and, therefore, require the same standards as for other teachers in the system. Unusually high levels of demand for speech-language and hearing services, as a result of recent federal legislation (i.e., P.L. 94-142, the Education for All Handicapped Children Act of 1975), may continue to have the effect of encouraging the use of personnel who have less than the ASHA-preferred level of training and experience.

[3/] U.S. Department of Health, Education, and Welfare, Speech Pathology and Audiology: Manpower Resources and Needs, National Institute of Neurological and Communication Disorders and Stroke, Monograph No. 17, 1977.

[4/] Applied Management Sciences, Report on Identified Methodologies and Interview Results, Interim Report on Contract No. (HRA) 232-80-0038, January 1981, pp. 4.13-4.37.

DEFINITIONAL CONSIDERATIONS

Prior to determining the supply or estimating requirements for services provided by speech-language and hearing professionals, it is essential that a consistent definition of each occupation be selected. However, as has been the case repeatedly throughout this report, the lack of a mandatory, nationwide credentialing mechanism for this profession has resulted in a lack of consistency in the definitions of the occupations of speech-language pathology and audiology.

Two different populations have been measured in the six data collection efforts for this profession: (1) the number of employed speech-language pathologists and audiologists, irrespective of credentialing status; and (2) the number of certified speech-language pathologists and audiologists. The lack of consistency in the definition of speech-language pathologists and audiologists used by the data sources reviewed in this study means that reliable estimates must be available for both the population of certified speech-language pathologists and audiologists and the noncertified population.

Speech-Language Pathologists

Although 30 states require licensure for speech-language pathologists, some of those who are employed in public school systems and in physicians' offices are exempt from the more stringent educational and experience requirements for licensure as a speech-language pathologist.

Prior to estimating the supply of speech-language pathologists, it is necessary to determine which definition of speech-language pathologist is to be used. The alternative definitions which may be proposed are:

(1) "Speech-language pathologists" may be defined as those individuals who have been certified by ASHA after having completed all educational, experiential, and examination requirements; or

(2) "Speech-language pathologists" may be defined as the total supply of persons employed or practicing as speech-language pathologists.

A substantial difference appears to exist in the supply of speech-language pathologists depending upon which definition is used.

Audiologists

Again, there is no consistency in the definition of this occupation. However, the general consensus among educators and professional association staff members in the speech-language and hearing field is that the number of noncertified audiologists is probably a small fraction of the audiology work force. In most instances, the minimum entry-level requirements for audiologists includes a master's degree.[5] Consequently, there may be only minimal differences between estimates of the total supply of audiologists and the total supply of ASHA-certified audiologists. For purposes of estimating the supply of these professionals, however, a choice should be made between these alternative definitions:

(1) "Audiologists" may be defined as those individuals who have been certified by ASHA after having completed all educational, experiential, and examination requirements; or

(2) "Audiologists" may be defined as the total supply of persons employed or practicing as audiologists.

SUPPLY OF SPEECH-LANGUAGE AND HEARING PROFESSIONALS

Data sources providing information on this field were identified and assessed. Results and recommendations are discussed separately for each element of this cluster, after an initial assessment of speech-langague pathologists and audiologists combined.

Speech-Language Pathologists and Audiologists

Data Sources: There have been six national work force survey efforts that have collected information on either the total number of speech-language pathologists and audiologists or the number or percentage employed in selected settings such as hospitals and nursing homes. Four of the studies report estimates for the combined category of speech-language pathologists and audiologists; these are:

(1) Occupational Employment Statistics Survey (BLS). Estimates of the number of speech-language pathologists and audiologists, irrespective of certification status, are available from the BLS survey for industries at the three-digit Standard Industrial Classification (SIC) level. The most recent estimates available are for 1978.

(2) National Nursing Home Survey (NCHS-NNHS). The NCHS-NNHS provides estimates of the number of full-time and part-time speech-language pathologists and audiologists, irrespective of certification status. The survey is not expected to be repeated at the present time.

(3) Survey of Hospital Staff (NCHS-SHS). The survey sought information on the number of certified and noncertified speech-language pathologists and audiologists employed in hospitals. It is not presently scheduled to be repeated.

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[5] Ibid, pp. 5.1-5.37.

(4) Survey of Members (ASHA-78). The American Speech-Language-Hearing Association provides information on the number of certified speech-language pathologists and audiologists on an annual basis. In addition, the Association conducts more detailed employment surveys of members of the Association on a periodic basis, most recently in 1978. Although ASHA has separated the certification process from membership in the Association, most fully trained and certified professionals belong to ASHA.

The AHSA-78 survey was conducted in the fall of 1978. Every fourth member of the American Speech-Language-Hearing Association was mailed a questionnaire which included a set of questions on employment status, income, age, sex, principal employer and certification status, among others. The response rate for this survey was 49 percent. No evidence is presented to indicate whether the respondents were representative of the population of AHSA members; hence, nonresponse bias cannot be ruled out.

Two additional studies collect data for the separate categories of speech-language pathology and audiology. These include:

(1) Allied Health Employment Matrix (AHEM). The AHEM project, contains national estimates for the separate categories of speech pathologists and certified audiologists for 1976. The AHEM study consists of an extrapolation of available state-level data on speech pathologists and audiologists to the national level. Only seven states provided acceptable data for speech-language pathologists, and only nine states provided data for audiologists. Most of the sample states were in the Northeast and North Central Census regions and probably should not be considered as representative of the U.S. population in general. In addition, a wide margin of error can be anticipated for national estimates derived from such a small sample of states. For these reasons, the AHEM estimates should be considered less reliable than estimates derived from the other studies.

(2) Survey of Manpower Resources and Needs (ASHA 72-73). The AHSA 72-73 survey was conducted by the American Speech and Hearing Association in 1972-73 for the National Institute of Neurological and Communication Disorders and Stroke. ASHA 72-73 presents data on speech-language pathologists and on audiologists, both members and nonmembers. Thus, although the ASHA 72-73 study is the most dated, it provides the most complete information for this field. The ASHA 72-73 study consists of a survey of every fourth member of AHSA (approximately 15,750 were members at that time) and one-fourth of identified nonmembers (ASHA estimated there to be approximately 12,500 nonmembers in the work force, 9,250 of whom were identified by collating various lists from other sources). The response rates for members and nonmembers were 62 percent and 35 percent, respectively. The ASHA 72-73 study presented a comparison of member respondents and nonrespondents on a number of key demographic variables for which information was available (i.e., education, professional activity, sex). The results of the comparison indicate that member respondents did not differ systematically from nonrespondents, at least along the dimensions available for comparison.

Data Assessment: The results of the evaluation of the estimates from various data sources are summarized in Tables 4.1 and 4.2. Even when differences in time frame and the sampling frames employed in the different efforts are taken into account, the results of the six studies do not form a consistent pattern. For example, the AHEM study underestimates the number of speech-language pathologists and audiologists relative to the other studies by a wide margin. This discrepancy can be attributed to methodological problems in the AHEM estimation procedure, the most important of which is the unrepresentativeness of the small set of states used in the estimation process.

The ASHA-78 estimate of members active in the profession is approximately 90 percent of the preliminary, unpublished BLS estimate of members and nonmembers active in the profession. ASHA 72-73 reports 23,352 member and nonmember speech-language pathologists and audiologists in 1972-73. However, only 55 percent of the total were estimated to be members of ASHA. Hence, a serious inconsistency exists among the results of the three studies. It appears that either the BLS estimate is biased downward or the ASHA 72-73 estimate of the number of nonmembers (estimated to be 12,500 in 1972) is biased upward.

A similar inconsistency exists for the estimates of the number of speech-language and hearing personnel employed in the school setting, the largest setting for this profession. The ASHA-78 estimate of employed members in the educational setting is approximately 70 percent of the BLS estimate. ASHA 72-73 reports that there were 16,086 member and nonmember speech-language pathologists and audiologists in this setting in 1972-73. However, only 44 percent were estimated to be members of ASHA. Again, either the BLS estimate for this setting is biased downward or the ASHA 72-73 estimate of the number of nonmembers employed in this setting is biased upward. In any event, the inconsistencies in both the estimated total supply of certified and noncertified speech-language pathologists and audiologists in the educational sector is due to the lack of a reliable estimate of the number of noncertified speech and hearing professionals, the majority of whom are employed in public school systems.

Rough consistency is obtained for the supply of speech-language and hearing personnel in hospitals and nursing homes among the various studies. However, most of the noneducational employment settings employ too few speech-language pathologists and audiologists to place much faith in the point estimates obtained. Rather, they should be viewed as providing a rough order of magnitude of the supply of speech-language and hearing personnel employed in these settings.

In summary, estimates of the total number of speech-language pathologists and audiologists, and of the number employed in the educational sector, are not consistent, even when differences in time frame and sampling frame employed in the different studies are taken into account. The difficulty in obtaining consistent estimates appears to be due to the fact that a substantial number of noncredentialed workers are employed in the field, in part as a result of an increased demand for

Table 4.1. Estimated Supply of Active Speech-Language Pathologists and/or Audiologists by Employment Setting and Data Source[1]

	Data Source				
Employment Setting	ASHA[2] (1978)	NCHS-NNHS (1977)	NCHS-SHS (1977)	AHEM[3] (1976)	ASHA (1973)
Total	28,812			11,200- 14,380	23,352
Nursing and Personal Care Facilities		2,600 FT			
Hospitals			2,300 FT 600 FT		3,429
Educational Services	15,991				16,086
All Others	12,821[4]				3,837

[1] BLS estimates do not appear because they were not available for publication at the time that this report was being prepared.

[2] Members of the American Speech-Language and Hearing Association who are active in the profession.

[3] Full-time equivalent (FTE), certified personnel only.

[4] Includes 5,439 in nursing and personal care facilities, hospitals, outpatient care facilities, and offices of physicians, dentists, and other health practitioners.

Table 4.2. Consistency of Estimates of Active Speech-Language Pathologists and Audiologists

Data Source	Coverage	Periodicity	Consistency of Estimate
BLS	Certified and Noncertified Speech-Language Pathologists and Audiologists, Total Supply and by Employment Setting	Triennial, most recently in 1978	Inconsistent with other estimates for total supply and educational employment settings. Roughly consistent with other estimates for noneducational employment settings.
ASHA-78	Certified Speech-Language Pathologists and Audiologists, Total Supply and by Employment Setting	Periodic, most recently in 1978	Inconsistent with other estimates for total supply and educational employment settings. Roughly consistent with other estimates for noneducational employment settings.
NCHS-SHS	Certified and Noncertified Speech-Language Pathologists and Audiologists in Hospitals	1977	Roughly consistent with other estimates for hospitals.
NCHS-NNHS	Certified and Noncertified Speech-Language Pathologists and Audiologists in Nursing Homes	1977	Roughly consistent with other estimates for nursing homes.
AHEM	Certified and Noncertified Speech-Language Pathologists, and Certified Audiologists, Total Supply	1976	Inconsistent with other estimates for total supply.
ASHA 72-73	Certified and Noncertified Speech-Language Pathologists, and Audiologists, Total Supply and by Employment Setting	1972-73	Inconsistent with other estimates for total supply and educational employment settings. Roughly consistent with other estimates for noneducational employment settings.

speech-language pathology and audiology services. Reliable estimates of the number of such workers are not currently available. Estimates of the number of certified speech-language pathologists and audiologists are available on a continual basis from the American Speech-Language-Hearing Association. In addition, the Association is also able to produce separate estimates of the number of active and inactive certified speech and hearing professionals. Slightly over five percent of the members of the Association were estimated to be inactive on the basis of the results of the 1978 survey of the membership.

Summary and Recommendations: Continuous, reliable estimates of the total number of speech-language pathologists and audiologists are not available. However, annual estimates of the number of certified speech-language pathologists and audiologists are available from the American Speech-Language-Hearing Association. Consequently, the following specific recommendations for estimation of the supply of these professionals are suggested:

> Recommendation 1: The total supply of certified speech-language pathologists and audiologists should be estimated using the continuous, reliable data available from the American Speech-Language-Hearing Association.
>
> Recommendation 2: It is recommended that all of the studies on speech and hearing personnel be reevaluated when the results of the 1980 Census of Population are made available. As a result of changes in the Standard Occupational Classification codes, the 1980 census will provide estimates of the total supply of speech-language pathologists and audiologists, and by employment setting. The Census results can then be contrasted with previous studies, in particular with the Bureau of Labor Statistics' Occupational Employment Statistics survey, to assess the consistency of the estimates for the total supply and by employment setting. More detailed recommendations for the separate categories of speech-language pathology and audiology are contained in the sections that follow.

Speech-Language Pathologists

Data Sources: Two of the six studies of speech-language and hearing personnel contain employment estimates for the separate category of speech-language pathology:

(1) Allied Health Employment Matrix (AHEM). The AHEM project sought information on the number of certified and noncertified speech-language pathologists employed in the United States.

(2) Survey of Manpower Resources (ASHA 72-73). The American Speech and Hearing Association survey sought information on the number of certified and noncertified speech-language pathologists employed in the United States. ASHA 72-73 was also able to estimate separately the number of speech-language pathologists who were certified and the number who were not certified. However, the results presented in the previous section indicate that little confidence can be placed in the ASHA 72-73 estimates of the number of noncertified personnel.

Neither source provides information on the total supply of speech-language pathologists on a continual basis. The American Speech-Language-Hearing Association is able to provide estimates of the number of certified speech-language pathologists on an annual basis, and of the number of employed, certified speech-language pathologists on a periodic basis. Estimates of the number of active speech-language pathologists from these two sources are presented in Table 4.3.

Data Assessment: As can be seen in Table 4.4, there is no consistency between the AHEM and ASHA 72-73 estimates of the total supply of employed speech-language pathologists. As was pointed out in the previous section, there were serious methodological problems in the AHEM estimation procedure for this occupation. The AHEM study underestimates the number of speech-language pathologists relative to the ASHA 72-73 study by a wide margin. Similarly, the reliability of the ASHA 72-73 estimate of the number of noncertified speech-language pathologists is not certain.

The only rough consistency between the two studies is for the estimated proportion of speech-language and hearing professionals who are classified as speech-language pathologists. The AHEM results indicate that between 86 and 88 percent of the total supply of speech-language and hearing personnel were speech-language pathologists. ASHA 72-73 reports that 75 percent of the member and 81 percent of the nonmember respondents described their professional speciality as speech-language pathology. Hence, although the estimated number of speech pathologists from the two studies were in sharp disagreement, the estimated proportion who are classified as speech-language pathologists is roughly consistent.

In summary, continuous, reliable estimates of the total number of speech-language pathologists are not available. However, annual estimates of the number of certified speech-language pathologists are available from the American Speech-Language-Hearing Association.

Summary and Recommendations: The lack of a mandatory, nationwide credentialing mechanism for this profession means that reliable estimates must be determined for both the certified and noncertified population. The American Speech-Language-Hearing Association provides an estimate for the total number of certified speech-language pathologists in all settings. However, there are no reliable estimates of the certified and noncertified population, or of the distribution of noncertified speech-language pathologists by employment setting. The following recommendations are offered in an effort to permit the development of such estimates.

Recommendation 1: The total supply of certified speech-language pathologists should be estimated using the continuous, reliable data available from the American Speech-Language-Hearing Association.

Recommendation 2: An attempt should be made to have the Bureau of Labor Statistics or the Bureau of Census include separate categories for speech-language pathologists and audiologists in their ongoing data collection efforts. Both sources currently provide continuous,

Table 4.3. Estimated Supply of Active Speech-Language Pathologists by Employment Setting and Data Source

	Data Source	
Employment Setting	AHEM[1] (1976)	ASHA-72-73 (1972-73)
Total	10,000-13,000	22,000

[1] Full time equivalent (FTE).

Table 4.4. Consistency of Estimates of Active Speech-Language Pathologists

Data Source	Coverage	Periodicity	Consistency of Estimate
AHEM	Certified and Noncertified Speech-Language Pathologists, Total Supply	1976	Inconsistent with ASHA 72-73 estimate for total supply.
ASHA 72-73	Certified and Noncertified Speech-Language Pathologists, Total Supply	1972-73	Inconsistent with AHEM estimate for total supply.

reliable estimates for a number of the allied health occupations under investigation. However, neither source currently collects data for the separate categories of speech-language pathologists and audiologists. Instead, the sources collect information at the cluster level for the combined category of speech-language pathologists and audiologists.

Recommendation 3: A second, more costly, approach to estimating the supply of certified and noncertified speech-language pathologists may be attempted. It would consist of collecting information on a random sample of speech-language pathologists to determine the ratio of certified to noncertified personnel in the sample. Since the number of active, certified speech-language pathologists is known, the ratio obtained from the sample survey could be used to extrapolate the total supply of speech-language pathologists.

The sample size required to estimate this ratio is not very large. For a confidence level of 95 percent, a sample of approximately 380 speech-language pathologists drawn at random will provide an estimate of the certified:noncertified ratio with assurance of a sampling error not exceeding five percent. To reduce the sampling error to three percent, a sample of approximately 1,000 speech-language pathologists would be required.

Sample selection procedures can be targeted to a specific employment setting. Estimates of the distribution of speech and hearing personnel by employment setting indicate that as much as 70 percent of the total supply is employed in the educational sector. Hence, little precision will be lost if sample selection procedures are focused on this setting. The general consensus of educators, professional association staff members, and practitioners in the field is that the vast majority of noncertified speech-language pathologists are employed in elementary and secondary schools. Many states regard speech-language professionals who provide services in public school settings as teachers and, therefore, require the same standards as for other teachers in the system. Hence, targeting the educational sector as the setting from which the sample will be drawn appears to be a feasible approach.

Audiologists

Data Sources: The same two studies--AHEM and ASHA 72-73--contain employment estimates for the separate category of audiologists:

(1) Allied Health Employment Matrix (AHEM). The AHEM project reported estimates of the number of certified audiologists only.

(2) Survey of Manpower Resources (ASHA 72-73). ASHA 72-73 reported the number of certified and noncertified audiologists.

Neither source provides information on the total supply of audiologists on a continual basis. The American Speech-Language- Hearing Association is able to provide estimates of the number of certified an annual basis and of the number of employed, certified audiologists on a periodic basis. Estimates from these two sources of the supply of active audiologists are presented in Table 4.5.

Data Assessment: As can be seen in Table 4.6, the estimates of the number of employed audiologists are of roughly the same order of magnitude in both studies, approximately 2,000. In addition, there is rough consistency between the estimates of the proportion of speech and hearing professionals who are classified as audiologists. The AHEM estimates indicate that between 12 and 14 percent of all speech-language pathologists and audiologists were certified audiologists. ASHA 72-73 reported that 13 percent of the member respondents and 1.5 percent of the nonmember respondents classified themselves as audiologists. The ASHA 72-73 finding also provides support for the contention that the number of noncertified audiologists is relatively small, as the vast majority of the work force was found to be certified members of the American Speech-Language-Hearing Association.

In summary, continuing data on the total number of audiologists employed in the U.S. are not available at present. However, annual estimates of the number of certified audiologists are available. In addition, certified audiologists constitute the vast majority of the audiology work force.

Summary and Recommendations: The lack of a mandatory, nationwide credentialing mechanism for this profession means that reliable estimates must be available for both the certified and noncertified population. The Speech-Language-Hearing Association provides an estimate for the total number of certified audiologists in all settings. However, there are no reliable estimates of the certified and noncertified population, or of the distribution of noncertified audiologists by employment setting. The following recommendations are offered in an effort to permit the development of such estimates.

Recommendation 1: The total supply of certified audiologists should be estimated using the continuous, reliable data available from the American Speech-Language-Hearing Association.

Recommendation 2: An attempt should be made to have the Bureau of Labor Statistics or the Bureau of Census include separate categories for speech-language pathologists and audiologists in their ongoing data collection efforts. Both sources currently provide continuous, reliable estimates for a number of the allied health occupations under investigation. However, neither source currently collects data for the separate categories of speech-language pathologists and audiologists. Instead, the sources collect information at the cluster level for the combined category of speech-language pathologists and audiologists.

Recommendation 3: A second, more costly, approach to estimating the supply of certified and noncertified audiologists may be attempted. It would consist of collecting information on a random sample of

Table 4.5. Estimated Supply of Active Audiologists by Employment Setting and Data Source

Employment Setting	Data Source AHEM[1] (1976)	 ASHA-72-73 (1972-73)
Total	1,600-1,800	2,250

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[1] Full time equivalent (FTE).

Table 4.6. Consistency of Estimates of Active Audiologists

Data Source	Coverage	Periodicity	Consistency of Estimate
AHEM	Certified and Noncertified Audiologists, Total Supply	1976	Roughly consistent with ASHA 72-73 estimate for total supply.
ASHA 72-73	Certified and Noncertified Audiologists, Total Supply	1972-73	Roughly consistent with AHEM estimate for total supply.

audiologists to determine the ratio of certified to noncertified personnel in the sample. Since the number of certified audiologists is known, the ratio obtained from the sample survey could be used to extrapolate the total supply of audiologists.

The sample size required to estimate this ratio is not very large. For a confidence level of 95 percent, a sample of approximately 325 audiologists drawn at random will provide an estimate of the certified: noncertified ratio with assurance of a sampling error not exceeding five percent. To reduce the sampling error to three percent, a sample of approximately 700 audiologists would be required.

Sample selection procedures can be targeted to specific employment settings. Estimates of the distribution of speech and hearing personnel by employment setting indicate that most audiologists are employed in hospitals, clinics, and private practice. Hence, targeting these settings as those from which the sample will be drawn appears to be a feasible approach.

REQUIREMENTS FOR SPEECH-LANGUAGE AND HEARING PERSONNEL

The derivation of appropriate criteria to indicate requirements for speech-language and hearing professionals was conducted in several pHASES: (1) interviews with knowledgable professionals to identify factors associated with current and future requirements for these specialists' services; (2) evaluation of the consistency and availability of data or supply of each profession; (3) development of recommendations for estimating current and future requirements for speech-language and hearing professionals; and (4) construction of personnel-to-population ratios for each profession, using the most reliable data available.

Interviews With Speech-Language and Hearing Personnel

A full description of the purpose, structure, and methodology used for the interview was provided in Chapter 2. In this section, a description of the selected interviewees, a summary of results, and a discussion of implications are presented.

Description of Interviewees: An attempt was made to achieve appropriate diversity among the individuals selected to be interviewed. Two individuals are staff at ASHA; one of whom has had responsibility for health-related practice activities and the other has expertise in education-related professional practice. Both of these persons were trained as speech-language and hearing professionals and had practiced prior to joining ASHA.

Three speech and hearing professionals were selected who are heads of academic programs. One program offers a research emphasis and produces doctorates only; the other program is strongly clinical in orientation and most graduates complete their training with a master's degree. The third individual is responsible for 20 departments including a program which includes undergraduate and graduate education of speech-language and hearing professionals.

Four supervisor/practitioners were chosen to participate in the interviews. One of these individuals heads a for-profit private practice with no outside sources of financial aid. Another interviewee in this category directs a non-profit clinic which provides services to a poor, rural population. A third participant supervises a university clinic. A final participant is employed by a public school system and provides speech therapy to students at three elementary schools.

An effort was also made to achieve some degree of geographic diversity of the interview participants. A summary matrix provided in table 7 depicts the categorical and geographic distribution of the 9 participants.

Results: There was general agreement among most interview participants that substantial shortage of speech-language and hearing services exists in the public school system. Currently, it has been estimated by ASHA that about 73 percent of new graduates get their first job in a public school setting.

There was also an apparent consensus among several of the interviewees that requirements for audiologists are growing more rapidly than requirements for speech-language pathologists outside the public school setting.

Concern was expressed by several interviewees about the number of states which permit baccalaureate professionals to practice in the public schools and in physicians' offices. This concern primarily affects speech-language pathology since, in most places, the minimum entry-level for audiologists requires a master's degree. Several of the interviewees indicated that they supported a universal requirement of, at least, a master's degree for clinical practice. However, many states regard speech professionals who provide services in public school settings as teachers and, therefore, require the same standards as for other teachers in the system.

The limited amount of third-party payment for services provided by speech-language and hearing professionals was also cited by most interviewees as a major consideration in this field. Medicare has extremely restrictive provisions covering reimbursement for services and disallows hearing aid equipment and associated services from coverage. Few private insurers offer speech and hearing therapy benefits.

Factors Affecting Needs-Based Estimates. The interview participants were in agreement on several factors which have had an impact on need for services of speech-language and hearing professionals:

(1) The increasing proportion of the population which is elderly is creating a larger population of persons with speech problems (due to stroke and other chronic or acute conditions) and with hearing problems associated with age.

Table 4.7. Matrix of Characteristics of Speech-Language and Hearing Interviewees

	GEOGRAPHIC REGION			
CATEGORY	NORTH EAST	NORTHCENTRAL	SOUTH	WEST
Association		XXX		
Academic	X	X		X
Employer/Supervisor		X	X	
Practitioner		XX		

(2) Need by the severely handicapped population for therapeutic services which contribute to their ability to function outside of institutions. Speech and hearing professionals have traditionally provided services to the moderately handicapped. A new emphasis on mainstreaming handicapped children and de-institutionalization of handicapped adults has created a need for more, and to some extent different, speech-language and hearing services.

(3) New technology and increases in knowledge have expanded the potential benefits from therapeutic services. This is particularly true for audiology as technology has affected both diagnostic and treatment capability.

No well-documented needs-based model was identified during this or earlier phases, of this project. In one study,[6] a variety of needs models are developed for speech-language and hearing services. These models are then used to project requirements for speech-language pathologists and audiologists to fulfill the estimated need for these services by the population. However, it is noted that:

> The primary sources for prevalence estimates were those provided annually by the Bureau of Education for the Handicapped, U.S. Office of Education (1977), and those contained in Human Communication and Its Disorders from the National Institute of Neurological Diseases and Stroke (1969). It is important to recognize, however, that estimates of prevalence, in the main, are based on relatively small studies that did not employ appropriate methodological controls. At best, prevalence estimates currently available should be viewed as educated guesses (p. 13).

Several interviewees stressed that there is a need to examine incidence, to re-evaluate concepts about communication impairment within the framework of changing knowledge of language acquisition and loss processes, and for needs assessment. One participant stated that the need for speech-language and hearing services is substantially greater than the demand, even when "need" is defined to include only those persons with problems which affect their ability to work and lead a normal life. She stated that, in her opinion, the profession has not done enough in the area of needs assessment; she has examined the literature and finds that the greatest lack is in severity ratings of disorders.

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[6] U.S. DHEW (1977), Op. Cit.

Two participants mentioned that needs evaluation should include consideration of issues of quality of care and especially of the appropriate caseload per practitioner to achieve optimal therapeutic results. The importance of this factor was emphasized by the practitioner providing services in a public school setting, who stated that she was unable to provide appropriate therapeutic services, due to time constraints, for a caseload of 45-50 students.

Factors Affecting Demand-Based Estimates. All of the interviewees were in agreement that legislation, and particularly P.L. 94-142, has had a profound impact on demand for speech-language and hearing services. One interviewee stated that there was a period, prior to P.L. 94-142, when it appeared that there was an oversupply of speech-language pathologists. With the passage of P.L. 94-142, however, there has been a dramatic increase in demand for speech-language pathologists (and to a lesser extent, audiologists) to work in public school systems.

All participants agreed that reimbursement issues have a substantial impact on demand. The expansion of the profession in recent years has been in settings (e.g., public schools) where services are supported by mechanisms other than third-party reimbursement. The fact that speech-language and hearing services are seldom included as a benefit in private insurance policies and are given limited coverage under Medicare and Medicaid creates a situation in which many persons with clear need for therapy are unable to obtain services. Nearly all of the interviewees stated that action which increases the extent and adequacy of reimbursement for services is essential if the profession is to develop and be able to satisfy currently unmet need.

Related to the effect of legislation and reimbursement is the concern expressed by several of the interviewees that the current emphasis on health cost containment and the generally conservative political atmosphere in the country will result in decreases in demand for speech-language and hearing services. Reductions in the scope and implementation of P.L. 94-142 were suggested as a possibility in the future by some participants. Others expressed concern that there may be cutbacks in the Medicare and Medicaid programs which would affect speech-language and hearing services. No one was optimistic about the potential for demand- increasing legislation or reimbursement changes.

Several interviewees indicated that increasing public awareness of the profession and of the benefits of speech-language and hearing therapy is essential. During the past two years, ASHA has begun activities designed to provide information to the public on the need for services. To the extent that the public and other professionals are aware of the benefits of speech-language and hearing services, demand for these services may increase.

Other Considerations. Several interviewees mentioned shifts in case-mix as of concern to the profession. One major effect of P.L. 94-142 has been to increase the demand for pathologists to work with severely handicapped children. To date, educational programs have been oriented toward working with moderately handicapped individuals. Some shift in the focus of education may be necessary to satisfy this demand. Although there may be an adequate supply of pathologists nationally, there may be a shortage of persons trained to work with specific groups.

Another factor mentioned by several participants is the maldistribution of speech-language and hearing services nationally. While several large cities (e.g., Chicago, Los Angeles, Denver) have an adequate (or excess) supply of professionals, other areas of the country have more difficulty attracting and retaining personnel.

Some individuals suggested that they expect shifts in distribution of personnel among employment settings. Specifically: (1) more speech-language pathologists and audiologists in public school settings; (2) more audiologists in private practice and dispensing and providing services associated with hearing aids; (3) speech-language and hearing professionals employed in greater numbers in nursing homes; and (4) speech-language and hearing services provided more commonly as a part of a larger complex of care rather than in free-standing clinics.

Finally, there was considerable concern by the majority of interviewees about the maintenance of high professional standards. Several mentioned the possibility of movement toward requiring a Ph.D. for certification in speech-language pathology or audiology. Two said that the profession had a responsibility to ensure that the pressure to produce more personnel to provide services in public schools did not result in graduation of less adequately trained professionals.

Five of the nine interviewees stated or implied that baccalaureate personnel are not adequately trained to provide professional services. One other interviewee said, however, that baccalaureate programs tend to provide strong technical proficiency to graduates, often requiring 500-600 hours of clinical experience. These graduates may be technically proficient but may not understand the theoretical basis of the field.

It seems clear that the role of the baccalaureate professional is a critical assumption in any estimate of requirements which may be based on personnel-to-population ratios. Similarly, attempts to evaluate adequacy of current or future supply of speech-language and hearing professionals must first address this issue.

Summary: Major areas of relevance to requirements estimates for speech and hearing services are summarized in table 8. Generally, the interviewees were pessimistic about the probability that demand for services (outside public school settings) would increase substantially in the near future.

Two critical areas for future research were identified in these interviews:

(1) prevalence studies to determine the need for services, including:

- development of severity ratings;
- examination of cost/benefit relationships between therapy and outcomes;

-- evaluation of optimal therapeutic effort necessary to achieve results.

(2) examination of the issues of services provision by baccalaureate personnel, including:

-- estimation of the current active supply of baccalaureate personnel;

-- examination of the differences in services provision and outcomes by baccalaureate personnel when compared with master's level speech-language and hearing personnel.

The latter is of substantial importance to requirements estimation for this occupation. Currently, approximately 6 states require speech-language and hearing personnel in the public schools to haveadvanced degrees, and meet other ASHA requirements for certification. If there is movement to impose these standards in other states, then the demand for ASHA-certified professionals will increase dramatically. Thus, definition of the group for which requirements are being estimated is to be a key determinant of any methodological approach to or recommendations for estimation of requirements for speech-language and hearing professionals.

Finally, it should be recognized that the factors outlined in table 8 are not a comprehensive set of requirements indicators. Other factors such as population, income, and education, among others, are expected to influence need and/or demand for speech-language and hearing services. Recommendations for estimation of requirements for speech-language pathologists and audiologists are presented in the separate occupation-specific sections which follow.

Recommendations for Estimating Requirements for Speech-Language and Hearing Personnel

Speech Pathologists

Estimating Current Requirements for Speech Pathologists

The general recommendations proposed in Chapter 2 of this report are that a personnel-to-population ratio be used to establish current requirements estimates. The following are specific recommendations for estimation of current requirements for speech-language pathologists:

Recommendation 1(a): If a decision is made to define the occupation as including only ASHA certified speech-language pathologists, then the speech-language pathologist-to-population ratio can be constructed using recent data on certified speech-language pathologists from ASHA.

Recommendation 1(b): If a decision is made to include the total supply of active speech-language pathologists, certified and noncertified, in the definition, then it is recommended that no separate estimate of requirements for speech-language pathologists be calculated. Instead, it is recommended that a combined estimate of requirements for speech and hearing personnel (i.e., speech-language pathologists and audiologists) be prepared.

Recommendation 2: Determination of a standard of adequacy for the certified speech-language pathologist-to-population ratio should be made. A national mean or a state median value may be appropriate. Since use of a national average would incorporate existing shortages into the requirements estimate, it is recommended that determination of the standard of adequacy take into account any existing evidence on the presence of a current shortage (e.g., number of job vacancies, rate of increase in salary levels).

Recommendation 3: Use of the speech-language pathologist-to-population ratio standard of adequacy to assess whether subnational geographic regions have sufficient speech-language pathologists to meet existing requirements should take into account characteristics of the subnational region in determining whether an excess or shortage of speech-language pathologists exists. Specifically, consideration should be given to the presence of employment settings in which speech-language pathologists may be employed (e.g., public schools, hospitals, rehabilitation centers) and state licensure requirements.

Estimating Future Requirements for Speech-Language Pathologists

The speech-language pathologist-to-population ratio and the standard of adequacy selected to estimate current requirements for certified speech-language pathologists will provide the bases for estimation of future requirements for speech-language pathologists.

One alternative approach to estimating future requirements is to assume that the certified speech-language pathologist-to-population ratio standard of adequacy represents the minimum level of future requirements. Therefore, projected increases in the population require that proportional increases in the numerator of the ratio occur. This approach has the advantage of simplicity but fails to take into account factors other than population growth which may be expected to affect requirements for speech pathologists in the future.

Interviews with individuals knowledgeable of the speech-language and hearing field focused, to a great extent, on factors which are expected to affect requirements for speech-language and hearing services in the future. A summary of the more relevant of the findings from these interviews has been provided in Table 4.8. Review of this information has resulted in the development of the following recommendations for determining future requirements for speech-language pathologists:

Table 4.8. Summary of Major Findings from Interviews with Speech-Language and Hearing Professionals

ISSUE	FINDINGS
Overview	o A shortage of professionals to work in public school systems exists.
	o Requirements (outside the public school systems) for audiologists appear to be increasing more rapidly than requirements for speech pathologists.
	o A major concern is ensuring quality of care and in establishing appropriate standards for practitioners.
Need Factors	o Increasing elderly population with chronic and acute diseases and hearing loss need services.
	o The severely handicapped are now functioning outside institutions and need services to assist in normal functioning.
	o Improvements and developments in technology are expanding the potential services available.
Demand Factor	o Legislation (e.g., P.L. 94-142) has had a substantial impact on demand for speech-language and hearing professionals.
	o Reimbursement for services by third-party payers is limited and erratic. This imposes a severe constraint on the growth of demand.
	o Increasing public awareness of the need for and benefits of speech-language and hearing services will influence demand.

Table 4.8. (Continued)

ISSUE	FINDINGS
Other Factors	o A shift in case-mix toward more severe problems suggests that a shortage of personnel with appropriate training may exist or develop. o Maldistribution of services exists, especially in rural and smaller urban areas. o Shifts in the distribution of professionals among employment settings has and may continue to occur with the major increase being seen in public school settings. o The issue of baccalaureate-level persons providing professional services is perceived as being of critical importance to the profession.

Recommendation 4: The standard of adequacy of the speech-language pathologist-to-population ratio selected for the estimation of current requirements should be used as the foundation for the development of estimates of future requirements for speech-language pathologists. Projections of future population size from the U.S. Bureau of the Census can be used to establish the denominator of the future ratio and the numerator (i.e., required number of speech-language pathologists to provide a constant level of services to the future population) can then be constructed.

Recommendation 5: Refinement of the estimate of future requirements for speech-language pathologists should take into account the factors indicated in Table 4.8, to the extent possible. While the direction of the effects of such factors on requirements may be clear, the magnitude of the impacts have not been determined. Consequently, it is recommended that professional opinions be sought prior to attempting to refine the ratio to permit adjusted future requirements to be calculated.

The importance of many factors, including population change, on future requirements is directly a function of the time interval over which future requirements are to be estimated. An estimate of future requirements for speech-language pathologists (i.e., 10 or more years away) must take into consideration a variety of factors including anticipated technological change, legislative trends, shifts in the age composition of the population, etc. The input of expert opinion to the latter estimate would be crucial; for a short-term estimate, expert opinion may be unnecessary. In all cases, it is clear that estimate of future requirements demands that judgmental decisions be made.

Audiologists

Estimating Current Requirements for Audiologists

The issues described above for speech-language pathologists apply also to audiologists. The specific recommendations for estimation of current requirements for audiologists parallel those for speech-language pathologists:

> Recommendation 1(a): If a decision is made to define the occupation as including only ASHA certified audiologists, then the audiologist-to-population ratio can be constructed using recent data on certified audiologists from ASHA.
>
> Recommendation 1(b): If a decision is made to include the total supply of active audiologists certified and noncertified, in the definition, then it is recommended that no separate estimate of requirements for audiologists be calculated. Instead, it is recommended that a combined estimate of requirements for speech and hearing personnel (i.e., speech-language pathologists and audiologists) be prepared.
>
> Recommendation 2: Determination of a standard of adequacy for the certified audiologist-to-population ratio should be made. A national mean or a state median value may be appropriate. Since use of a national average would incorporate existing shortages into the requirements estimate, it is recommended that determination of the standard of adequacy take into account any existing evidence on the presence of a current shortage (e.g., number of job vacancies, rate of increase in salary levels).
>
> Recommendation 3: Use of the audiologist-to-population ratio standard of adequacy to assess whether subnational geographic regions have sufficient audiologists to meet existing requirements should take into account characteristics of the subnational region in determining whether an excess or shortage exists. Specifically, consideration should be given to the presence of employment settings in which audiologists may be employed (e.g., public schools, hospitals, rehabilitation centers) and state licensure requirements.

Estimating Future Requirements for Audiologists

The issues involved in estimating future requirements for audiologists are identical to those discussed above for speech-language pathologists and require that the factors presented in Table 4.8 be taken into consideration. Consequently, the following recommendations for estimating future requirements for audiologists closely parallels the recommendations developed for speech-language pathologists:

Recommendation 4: The standard of adequacy selected for the estimation of current requirements for certified audiologists should be used as the foundation for the development of estimates of future requirement. Projections of future population size from the U.S. Bureau of the Census can be used to establish the denominator of the future ratio and the numerator (i.e., required number of audiologists to provide a constant level of services to the future population) can then be constructed.

Recommendation 5: Refinement of the estimate of future requirements for audiologists should take into account the factors indicated in Table 4.8, to the extent possible. While the direction of the effects of such factors on requirements may be clear, the magnitude of the impacts has not been determined. Consequently, it is recommended that professional opinions be sought prior to attempting to refine the ratio to permit adjusted future requirements to be calculated.

In all projections of requirements for allied health workers, it should be recognized that the further into the future for which the projection is estimated, the less reliable are the estimates produced likely to be.

Combined Speech-Language and Hearing Professions

If a decision is made to define speech-language pathology and audiology professionals by function, rather than by ASHA certification status, then it has been recommended above (Speech-Language Pathology Recommendation 1(b) and Audiology Recommendation 1(b)) that a combined estimate of requirements for the total supply of speech-language pathologists and audiologists be calculated. The reason for this recommendation is the lack of data on the total supply of certified and noncertified personnel in speech-language pathology and audiology as separate occupations. More data sources are available on the combined category of personnel, including estimates of the total supply of professionals, certified and noncertified. Table 4.2 summarizes the data sources which provide data on either (1) the total number of speech-language pathologists and audiologists, or (2) the number or percentage employed in selected settings.

Examination of the estimates in Table 4.2 reveals that even when differences in time frame and the sampling frames employed in the different efforts are taken into account, the results of the six studies do not form a consistent pattern. For example, the AHEM study underestimates the number of speech-language pathologists and audiologists relative to the other studies by a wide margin. This discrepancy can be attributed to methodological problems in the AHEM estimation procedure, the most important of which is the under-representativeness of the small set of states used in the estimation process.[7] BLS reports 32,102 full-time and part-time speech-language pathologists and audiologists employed in all settings in 1978. ASHA-78 reports 28,812 members active in the profession, 90 percent of the BLS estimate. ASHA 72-73 reports 23,352 full-time and part-time speech-language pathologists and audiologists in 1972-73. Hence, a serious inconsistency exists among the results of the three studies. It appears that either the BLS estimate is biased downward or the ASHA 72-73 estimate of the number of nonmembers (estimated to be 12,500 in 1972) is biased upward.

Similar inconsistencies are apparent when estimates are compared for different employment setting. In summary, estimates of the total number of speech-language pathologists and audiologists, and of the number employed by setting, are not consistent even when differences in time frame and sampling frame employed in the different studies are taken into account. The difficulty in obtaining consistent estimates appears to be due to the fact that a substantial number of noncredentialed workers are employed in the field, in part as a result of an increased demand for speech-language pathology and audiology services.

It is not possible at this time to state with certainty that any reliable data source on the total supply of speech-language and hearing personnel exists. However, based upon the high level of accuracy and consistency of the Bureau of Labor Statistics' estimates for other occupations,[8] the likelihood that this estimate approaches reliability seems relatively high.

Estimates of Current and Future Requirements for Combined Speech-Language Pathologists and Audiologists

The development of recommendations for estimation of current and future requirements for speech-language and hearing professionals is based upon the general discussion in Chapter 2. The specific recommendations for the combined category of professionals are:

> Recommendation 1: If a decision is made to define the speech-language and hearing disciplines as composed of all certified and noncertified practitioners, then it is recommended that the Bureau of Labor Statistics estimates of total supply be used as the numerator in the speech-language and hearing personnel-to-population ratio.

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[7] For a more detailed description of the AHEM estimation procedure, see: Applied Management Sciences, Evaluation of Data Procedures and Estimates Derived from Multiple Sources, October 1980.

[8] See table 2.1, pp. 2.4-2.6, Evaluation of ..., op. cit.

Recommendation 2:

See Speech-Language Pathologist Recommendation 2 and Audiologist Recommendation 2

Recommendation 3:

See Speech-Language Pathologist Recommendation 3 and Audiologist Recommendation 3

Recommendation 4:

See Speech-Language Pathologist Recommendation 4 and Audiologist Recommendation 4

Recommendation 5:

See Speech-Language Pathologist Recommendation 5 and Audiologist Recommendation 5

It should be recognized that these recommendations are based on the presumption that (1) the desired definition of speech-language pathologists and audiologists encompass the total supply of certified and noncertified personnel; and (2) the BLS estimates offer the greatest likelihood of accuracy. If the latter presumption is incorrect, then the estimates of current and future requirements for these professionals will be correspondingly inaccurate. Therefore, a final recommendation is offered which should be taken under consideration if the desired definition of speech-language and hearing professionals encompasses both certified and noncertified personnel.

Recommendation 6: If estimates of requirements for the total supply of speech-language and hearing professional are desired, further efforts should be initiated to validate the BLS estimates for total supply. Alternatively, a survey of the population should be conducted to collect data on total supply which can be used as an independent estimate and to compare with and validate the BLS and other estimates.

Personnel-to-Population Ratios

Thorough review of the information obtained during the conduct of the present study resulted in a conclusion that construction of personnel-to-population ratios for certified speech-language pathologists and audiologists was possible, both at the national level and at the state level. These estimates are presented in Tables 4.9, 4.10, and 4.11.

It should be stressed that these ratios are based on estimates for the certified population. There are, as has been discussed above, a substantial number of noncertified individuals providing speech-language and hearing services. No reliable data are available to permit calculation of personnel-to-population ratios which include this group.

Table 4.9. National Personnel-to-100,000 Population Ratios, Certified Speech-Language and Hearing Personnel, 1980

Occupation	Total Supply, 1980	Personnel-to-100,000-Population
Speech-Language Pathologists (Certified)	25,526	11.25
Audiologists (Certified)	5,127	2.26
Combined Speech-Language and Hearing Work Force (Certified)	30,653	13.53

SOURCES: (1) 1980 American Speech-Language-Hearing Association Membership Files.

(2) U.S. Bureau of the Census.

Table 4.10. Certified Speech-Language Pathologists-to-100,000, Population, by State, 1980

State	Number of Speech-Language Pathologists	Personnel-to-100,000 Population
Alabama	279	1.23
Alaska	48	11.98
Arizona	333	12.25
Arkansas	197	8.61
California	3,280	13.85
Colorado	653	22.60
Connecticut	645	20.75
Delaware	63	10.58
District of Columbia	118	18.50
Florida	1,021	10.48
Georgia	479	8.76
Hawaii	124	12.84
Idaho	107	11.33
Illinois	1,805	15.8
Indiana	584	10.63
Iowa	603	20.69
Kansas	521	22.04
Kentucky	286	7.81
Louisiana	473	11.25
Maine	124	11.02
Maryland	984	23.33
Massachusetts	974	16.97
Michigan	1,006	17.53
Minnesota	535	13.12
Mississippi	230	9.12
Missouri	597	12.14
Montana	189	24.02
Nebraska	285	18.15

Table 4.10. (Cont.)

State	Number of Speech-Language Pathologists	Personnel-to-100,000 Population
Nevada	52	6.5
New Hampshire	76	8.25
New Jersey	1,007	13.67
New Mexico	196	15.07
New York	2,828	16.10
North Carolina	512	8.71
North Dakota	81	12.41
Ohio	1,116	10.33
Oklahoma	328	10.84
Oregon	404	15.34
Pennsylvania	1,335	11.24
Rhode Island	133	14.04
South Carolina	271	8.68
South Dakota	85	12.31
Tennessee	439	9.56
Texas	1,529	10.74
Utah	153	10.47
Vermont	105	20.52
Virginia	693	12.96
Washington	514	12.44
West Virginia	212	10.87
Wisconsin	916	19.46
Wyoming	56	11.89

SOURCES: (1) 1980 American Speech-Language-Hearing Association Membership Files.

(2) U.S. Bureau of the Census.

Table 4.11. Certified Audiologists-to-100,000 Population, by State, 1980

State	Number of Audiologists	Personnel-to-100,000 Population
Alabama	87	2.23
Alaska	18	4.49
Arizona	86	3.16
Arkansas	49	2.14
California	644	2.72
Colorado	127	4.39
Connecticut	98	3.15
Delaware	15	2.52
District of Columbia	52	8.15
Florida	230	2.36
Georgia	102	1.86
Hawaii	32	3.31
Idaho	24	2.54
Illinois	360	3.15
Indiana	132	2.40
Iowa	142	4.87
Kansas	77	3.25
Kentucky	68	1.85
Louisiana	108	2.56
Maine	25	2.22
Maryland	224	5.31
Massachusetts	233	4.06
Michigan	229	2.47
Minnesota	97	2.37
Mississippi	43	1.70
Missouri	108	2.19
Montana	42	5.33
Nebraska	58	3.69

Table 4.11. (Cont.)

State	Number of Audiologists	Personnel-to-100,000 Population
Nevada	15	1.87
New Hampshire	19	2.06
New Jersey	170	2.30
New Mexico	40	3.07
New York	620	3.53
North Carolina	126	2.14
North Dakota	25	3.83
Ohio	291	2.69
Oklahoma	64	2.11
Oregon	72	2.73
Pennsylvania	307	2.58
Rhode Island	29	3.06
South Carolina	63	2.01
South Dakota	18	2.60
Tennessee	145	3.15
Texas	342	2.40
Utah	66	4.51
Vermont	11	2.15
Virginia	145	2.71
Washington	147	3.55
West Virginia	61	3.12
Wisconsin	131	2.78
Wyoming	11	2.33

SOURCES: (1) 1980 American Speech-Language-Hearing Association Membership Files.

(2) U.S. Bureau of the Census.

Chapter 5
Dental Auxiliary Services

OVERVIEW OF THE PROFESSION

For the purposes of this study, dental auxiliary services are defined as follows: those dental care services which are provided in support of the dentist or directly to the patient, under the supervision of the dentist or otherwise according to the laws of the state. The field consists mainly of practitioners of three occupations--dental hygienists, dental assistants, and dental laboratory technicians--whose job responsibilities vary widely, depending upon the background, training, and skills of the individual, and on the state and practice in which he or she is employed. In general, however, each of the three occupations comprising the field of dental auxiliary services will be discussed in terms of their basic functions, as described below.

In a report to Congress by the Bureau of Health Professions (BHPr),[1] dental hygienists are described as "oral health clinicians and educators who help the public develop and maintain good oral health." They traditionally provide direct patient care services, including oral inspection, prophylaxis, application of decay preventive agents, and patient education in oral hygiene and diet practices as they relate to dental health. In addition, hygienists frequently take medical and dental histories, expose and process dental radiographs, make impressions of teeth for study casts, and prepare other diagnostic aids for use by the dentist. Although the American Dental Association opposes delegation of "expanded functions" to dental auxiliaries, in some states hygienists are permitted to perform expanded functions such as the administration of local infiltration anesthesia and the placing, carving, and polishing of restorations, if they have obtained the necessary training.

The dental assistant's primary function is described as being "to assist the dentist in treating patients."[2] Specifically, the assistant's functions may include preparation of the patient, maintaining a clear operating field, passing instruments and materials to the dentist, and the preparation of materials used during treatment. In addition, the assistant may be responsible for sterilization of instruments, preparation of tray setups for dental procedures, and preparation of study casts, as well as management of the dental office. Some assistants also provide oral hygiene instructions to patients, and some states allow them to perform expanded functions such as exposing and processing radiographs, making impressions for study casts, and polishing crowns of teeth.

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[1] U.S. DHEW. A Report on Allied Health Personnel. DHEW Publication No. (HRA) 80-28, 1979, p. VII-2.

[2] Ibid., p. VII-9.

Dental laboratory technicians provide complementary services involving precision instruments, machinery, and other special equipment. They manipulate and shape materials such as acrylics, ceramics, and metals to construct complete and partial dentures, crowns, bridges, and orthodontic devices, in response to a written prescription or work order by a dentist.

Of the three occupations described above, two (dental hygienist and dental assistant) are predominately female, while the third (dental laboratory technician) seems to include more males. This could be due to two factors:

- first, in dental auxiliary services, as in other professions, there has historically been a tendency for men to be attracted to more technical fields, according to traditionally accepted occupational roles;
- second, the greater degree of (financial and professional) independence enjoyed by dental laboratory technicians (most of whom work in commercial laboratories rather than in dentists' offices) is also indicative of traditionally male-dominated professions.

This situation appears to be changing, however, especially in the field of dental hygiene, as higher income opportunities attract more males.

In addition to the sexual composition of the work force, it is interesting to note that dental hygienists constitute a relatively young group. As pointed out in the BHPr report:[3]

> "Of all hygienists active in 1976, at least one-half had graduated in the preceding 5 years. In 1976, about half of all active hygienists were 25 years old or less. Over 75 percent of the active supply was less than 35 years of age. Only 5 percent of active dental hygienists was estimated to be 55 or older."

This suggests that the field of dental hygiene has been changing rapidly, since younger practitioners are more likely to incorporate new techniques and practice styles.

Finally, the rapid growth of all three dental auxiliary occupations over the last three decades (Table 5.1) indicates that the nature of services provided by these practitioners, as well as the degree and type of interactions between these occupations and between dental auxiliaries and practicing dentists, has changed considerably. These issues are discussed more fully below.

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[3] Ibid., p. VII-3.

Table 5.1. Growth of Dental Auxiliary Labor Force, 1950-1977

Occupation	Work Force 1950	Work Force 1977	Average Annual Percent Increase
Dental Hygienists	3,190	32,300	8.9%
Dental Assistants	55,200	144,700	3.6%
Dental Laboratory Technicians	15,000	45,100	4.2%

SOURCE: Health Resources Administration, Bureau of Health Manpower, Division of Dentistry

The three occupations comprising the field of dental auxiliary services differ substantially in their educational requirements and credentialing procedures. This variation is accentuated by state-to-state differences in dental practice laws, which specify the functions which dental auxiliary personnel are allowed to perform.

Dental hygienists are licensed in all states, and some states have additional requirements for hygienists who perform expanded functions. In order to practice dental hygiene (in every state except Alabama), the hygienist must have graduated from an accredited program, as well as being required to pass a written and clinical examination.

Certification of dental assistants is a voluntary mechanism supervised by the Dental Assisting National Board, Inc. However, according to the BHPr report,[4] only 11 percent of currently active dental assistants are certified. For assistants who perform expanded functions, most states have only limited and inconsistent credentialing requirements, if any at all. According to the BHPr report,[5] between 15 and 20 percent of all active technicians were certified in 1974.

As stated above, the setting in which dental auxiliary personnel are employed is a crucial factor in determining the functions performed by these personnel. Currently, the vast majority of dental hygienists are employed in private dental offices.[6] Among 4,847 dental hygiene graduates in 1977, 83 percent were thus employed. Other employment settings for hygienists include schools, hospital clinics, public health departments, and military installations. In addition, there was some indication of a trend toward establishing independent dental hygiene practices in some states.

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[4] *Ibid.*, p. VII-20.

[5] *Ibid.*, p. VII-20.

Dental assistants, by nature of their occupation, must work directly with dentists in providing dental care. Thus, the overwhelming tendency is for dental assistants to work in private dental offices. According to the BHPr report,[7] 77 percent of 1977 graduates were practicing in private dental offices. Other work settings for dental assistants include dental schools, military dental clinics, and public health clinics.

In contrast to dental hygienists and assistants, dental laboratory technicians are usually employed in commercial laboratories. Some technicians also work in dentists' offices, and others are employed in dental school laboratories, in hospitals, or in faculty teaching positions.

DEFINITIONAL CONSIDERATIONS

Prior to determining the supply or estimating requirements for services provided by dental auxiliary services personnel, it is essential that a consistent definition of each occupation be selected. For dental hygienists the definition of the field is good; for dental assistants and dental laboratory technicians the definitions are more vague, however, it is fairly simple to collect consistent estimates of supply for these groups.

Dental Hygienists

The existence of universal licensure requirements makes dental hygiene a well defined occupational field. As a result, estimation of supply and use of the personnel-to-population ratio standard to establish current requirements for dental hygienists is fairly straightforward, as definitions and educational and credentialing requirements are almost universally applied for this auxiliary profession.

Dental Assistants

Unlike hygienists, dental assistants need not be licensed. A majority of dental assistants work without the voluntary certification which is available to them. However, some states have mandatory registration requirements-often involving formal education and passing an examination for those dental assistants performing more advanced procedures.

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[6] *Ibid.*, p. VII-2.
[7] *Ibid.*, p. VII-10.

As the definition of dental assistant is somewhat vague, a wide range may exist in the level of expertise and functions performed by dental assistants. Some are formally trained and credentialed, others are trained on-the-job, but all work under the supervision of a dentist. Prior to determining supply and estimating requirements for dental assistants, therefore, it will be necessary to select a definition of the profession to be used for this purpose. Two alternative definitions are suggested:

(1) "Dental assistants" may be defined as those who are employed and who have met requirements for registration or certification by one or more professional association or governmental agencies; or

(2) "Dental assistants" may be defined as those who are employed and perform the chairside functions of a dental assistant.

Dental Laboratory Technicians

Credentialing for dental laboratory technicians is a matter of voluntary registration which is awarded by the National Association of Dental Laboratories after five years work experience. Many technicians are not registered. Although credentialing and formal training for dental laboratory technicians is not uniform, the well defined functions of the profession make it fairly simple to collect consistent personnel estimates.

Two alternative definitions of "dental laboratory technicians" are suggested:

(1) "Dental laboratory technicians are defined as those who are employed and who have been certified by the National Board for Certification in Dental Laboratory Technology.

(2) "Dental laboratory technicians" are defined as those who are employed and perform the functions of a dental laboratory technician.

SUPPLY OF DENTAL AUXILIARY SERVICES PERSONNEL

Data sources providing information on the supply of dental hygienists, dental assistants, and dental laboratory technicians were identified and assessed. Results and recommendations are discussed separately for each of these dental auxiliary fields.

Dental Hygienists

Data Sources: There are four sources of estimates of the total supply of dental hygienists. These sources are discussed below.

(1) Occupational Employment Statistics Survey (BLS). Data were collected by employment setting on all licensed dental hygienists. Since all dental hygienists must be licensed, no provisions had to be made for the inclusion of noncredentialed personnel.

(2) Census of Population (Census). The 1970 Census was conducted primarily by mail. Detailed questionnaires, including questions on occupation and industry of employment, were sent to a 20 percent sample of the population.

(3) Current Population Survey (CPS). Each year, since 1972, Employment and Earnings has reported annual averages, including annual estimates of employment of dental hygienists. The most recent year for which estimates have been examined in the current effort is 1979.

(4) A Report on Allied Health Personnel (HRA). This study was developed by the Health Resources Administration as a report to Congress. The HRA estimate of dental hygienists was produced by taking advantage of the data made available by the existence of universal licensure. The HRA compiled data on the production of these trained personnel that go back to the beginning of such programs in the 19th century. To measure attrition from these cohorts of qualified graduates, HRA contracted with the Association of Dental Examiners in the 1960s to obtain state-by-state listings of licensed hygienists. HRA's predecessor agency then surveyed these workers to obtain information about their age and current work status. Attrition formulae derived from these data have subsequently been applied to the production figures for annual graduates, allowing projection for the current (and presumably future) supply of active hygienists. One reason for preferring this approach over others (such as extrapolation from dental practice data on the number of hygienists per dentist) is that some hygienists are known to work for more than one practitioner.

In all data sources, the issue of defining the population is greatly simplified by the existence of universal licensure requirements for dental hygienists. The estimates produced by these sources are presented in Table 5.2.

Data Assessment: The estimates of the supply of dental hygienists are consistent with one another, probably due to consistency in the definition of the study population. The evaluation of these estimates is summarized in Table 5.3. The Census estimate for 1970 fits well into the growth trend implied by the CPS estimates for 1972 through 1979. The HRA estimate for 1977, although a bit lower than the CPS estimate for the same year, is sufficiently close that the difference may be attributable to sampling error.

Table 5.2. Estimated Supply of Active Dental Hygienists by Employment Setting and Data Source[1]

	Data Source		
Employment Setting	HRA (1977)	CPS (1979)	Census (1970)
Total	32,200	43,000	15,805
Dentists' Offices			12,863
All Others			2,942

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[1] BLS estimates do not appear because they were not available for publication at the time that this report was being prepared.

Only the preliminary, unpublished BLS estimate is inconsistent with the other figures. This estimate is high, even when compared to the CPS estimate for one year later. Similarly, if a comparable growth rate is assumed for dental hygienists in dentists' offices as is observed for all employment settings, the BLS estimate for dentists' offices is inconsistent when compared to Census, the only other source which provides data by employment setting. The proportion of dental hygienists that are employed in dentists' offices is also higher in the BLS estimate than is indicated by Census (96 percent vs. 81 percent).

A possible explanation for higher estimates from the Bureau of Labor Statistics is that many dental hygienists work part time, often for more than one dentist. An employer-based survey, such as BLS, would tend to double-count these part-time, multiple-employer hygienists. Since this trend seems to be limited to hygienists in private dentists' offices, such double-counting would inflate the estimate for hygienists in dentists' offices, and probably wouldn't affect estimates for other employment settings. This seems to be one case where a specific characteristic of an individual occupation makes the use of an employer-based survey less appropriate for estimating the number of people actively employed in that occupation.

Summary and Recommendations: Dental hygiene is an occupation for which a well understood definition exists and for which reliable, continuing data are available to measure the supply of the work force. Consequently, the following specific recommendations for estimation of the supply of dental hygienists are suggested:

> Recommendation 1: It is recommended that the Census Bureau's Census of Population and Current Population Survey be used for estimates of the total supply of dental hygienists.
>
> Recommendation 2: It is further recommended that the Census of Population be used for estimates of the supply of dental hygienists by employment setting, even though the reliability of the estimates cannot be assured. However, the Census employment setting estimates should be reevaluated when future results from the Bureau of Labor Statistics' Occupational Employment Statistics survey or other survey efforts are made available.

Table 5.3. Consistency of Estimates of Active Dental Hygienists

Data Source	Coverage	Periodicity	Consistency of Estimate
HRA	Licensed Dental Hygienists, Total Supply	1977	Consistent with CPS and Census for total supply.
BLS	Licensed Dental Hygienists, Total Supply and by Employment Setting	Triennial, most recently in 1978	Inconsistent with other estimates for total supply and for dentists' offics.
Census	Licensed Dental Hygienists, Total Supply and by Employment Setting	Decennial, most recently in 1970	Consistent with CPS for total. Consistent with HRA for total. Inconsistent with BLS for dentists' offices.
CPS	Licensed Dental Hygienists, Total Supply	Annual, most recently in 1979	Consistent with HRA for total supply. Inconsistent with BLS for total supply.

Dental Assistants

Data Sources: The same four sources which supplied estimates for dental hygienists also provide data on dental assistants.

(1) Occupational Employment Statistics Survey (BLS). The Bureau of Labor Statistics collected data, by employment setting, on the number of dental assistants, certified and noncertified, in the active work force in 1978.

(2) Census of Population (Census). The 1970 census collected data by employment setting on the Standard Occupational Classification (SOC) category, "dental assistants." This category makes no distinction between certified and noncertified personnel.

(3) Current Population Survey (CPS). CPS uses the same occupational classification as Census. Annual averages from this monthly survey are published in the Bureau of Labor Statistics publication, Employment and Earnings.

(4) A Report on Allied Health (HRA). The lack of licensure data required that HRA adopt an estimation procedure different from that used for dental hygienists. HRA's own studies show that the use of dental assistants is strongly associated with the age of the employing dentist. Accordingly, HRA based its estimate for dental assistants on annual data on the age of practicing dentists, extrapolating to derive the number of assistants by using the results of a special 1967-70 practice study of all licensed dentists.[8]

The estimates for dental assistants are presented in Table 5.4.

Data Assessment: As was the case with dental hygienists, there is a large degree of consistency among the estimates of the total supply of active dental assistants. The evaluation of the estimates is summarized in Table 5.5 The one estimate for dental assistants which seems inconsistent with the others is the HRA estimate. The HRA estimate for 1977 is higher than the highest CPS estimate for three years later. It seems likely that the inconsistency of the HRA estimate may be due to the methodology used in producing the estimate, a methodology which rests on several key assumptions. These assumptions involve the number of assistants per dentist and the relationship between the number of assistants employed and the dentist's age.

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[8] Health Resources Administration. Auxiliaries per Dentist in Relation to Certain Dental Practice Characteristics. DHEW Pub. No. (HRA) 78-7, Washington, D.C. 1977.

Table 5.4. Estimated Supply of Active Dental Assistants by Employment Setting and Data Source[1/]

	Data Source		
Employment Setting	HRA (1977)	CPS (1979)	Census (1970)
Total	144,700	134,000	88,175
Dentists' Office			79,860
All Others			8,315

[1/] BLS estimates do not appear because they were not available for publication at the time that this report was being prepared.

Table 5.5. Consistency of Estimates of Active Dental Assistants

Data Source	Coverage	Periodicity	Consistency of Estimate
HRA	Certified and Noncertified Dental Assistants, Total Supply	1977	Inconsistent with other estimates for total supply.
BLS	Certified and Noncertified Dental Assistants, Total Supply and by Employment Setting	Triennial, most recently in 1978	Consistent with Census and CPS for total supply. Consistent with Census for dentists' office.
Census	Certified and Noncertified Dental Assistants, Total Supply and by Employment Setting	Decennial, most recently in 1970	Consistent with BLS and CPS for total supply and dentists' offices.
CPS	Certified and Noncertified Dental Assistants, Total Supply	Annual, most recently in 1979	Consistent with BLS and Census for total supply.

The preliminary, unpublished BLS estimate for 1978 is consistent with both the CPS estimate for the same year and the trend in the CPS estimates between 1972 and 1979. The 1970 census estimate also fits well into that trend.

The only sources which provide estimates by employment setting are, again, BLS and Census. Dental assistants are even more likely to be employed in dentists' offices than are dental hygienists, and BLS and Census are in close agreement on the percentage of total assistants who are employed in this largest setting (BLS preliminary, unpublished estimates show 93.6 percent in dentists' offices and Census shows 90.6 percent).

Summary and Recommendation: The occupation of dental assistant is one for which a consistently adopted definition exists and for which reliable, continuous data are available to measure the size of the profession. Consequently, the following recommendation is suggested for estimation of the supply of dental assistants:

> The Occupational Employment Statistics survey (BLS), the Census of Population (Census) and the Current Population Survey (CPS) provide continuous, reliable estimates of the total supply of dental assistants. BLS and Census also provide reliable estimates for major employment settings. It is recommended that all of these sources be used to estimate the supply of dental assistants.

Dental Laboratory Technicians

Data Sources: BLS does not provide estimates of the supply of dental laboratory technicians. The other three sources of data for the other dental auxiliary professions also provide estimates for this occupation. All estimates include both registered and nonregistered dental laboratory technicians.

Once again, the three sources which provide estimates are as follows:

(1) Census of Population (Census). Census collects data by employment setting on the SOC category, "dental laboratory technician." This includes certified and noncertified personnel.

(2) Current Population Survey (CPS). CPS uses the same occupational category as Census. These estimates are for total supply only, and the latest data examined in the current effort are from 1979.

(3) A Report on Allied Health (HRA). The primary method used by HRA in developing its estimate for dental laboratory technicians involved estimating an average number of technicians per laboratory and applying that average to a count of private laboratories, the most common setting for dental laboratory technicians. The HRA estimate, then, is an employer-based estimate.

The estimates of the supply of dental laboratory technicians, both total and by employment setting, are presented in Table 5.6.

Data Assessment: The existing estimates of the total supply of active dental laboratory technicians are consistent with one another. The evaluation is summarized in table 7. The HRA estimate for 1977 is a bit higher than the CPS estimates for the same and surrounding years. This may indicate some double-counting in the employer-based estimate. The growth rate implied by the difference between the 1970 Census estimate and the 1972 CPS estimate is consistent with that observed among the earliest of the CPS estimates, although the CPS estimates increase at a slower rate in the later years.

The fact that BLS provides no estimates for dental laboratory technicians leaves Census as the only source of estimates by employment setting, as well as the only source of an estimate of inactive technicians. According to Census, dental laboratory technicians are predominantly employed in "health services, n.e.c." in which dental laboratories are included. This category included 69.3 percent of the Census total. Census also estimates, from its five percent sample, that there were 27,376 dental laboratory technicians in the experienced civilian labor force and 768 inactive dental laboratory technicians in 1970. Once again, the smaller sample size used for the experienced civilian labor force must be taken into consideration, as the sampling error for this estimate necessarily increases with the smaller sample size.

Summary and Recommendations: The occupation of dental laboratory technician is one for which a consistently adopted definition exists and for which continuous, reliable data are available for estimating the size of the work force. Consequently, the following specific recommendations are made for the estimation of the supply of dental laboratory technicians:

> Recommendation 1: It is recommended that the Census Bureau's Census of Population and Current Population Survey be used by the Bureau of Health Professions for estimates of the total supply of dental laboratory technicians.
>
> Recommendation 2: It is further recommended that the Census of Population be used for estimates of the supply of technicians by employment setting, even though the reliability of these estimates cannot be assured.

In summary, consistently adopted definitions exist for all three of the occupations in the dental auxiliary cluster. Reasons for this include universal licensure for dental hygienists and the existence of long established, well defined functions for dental assistants and dental laboratory technicians. Definitional consistency contributes to consistency among the estimates of supply for these occupations. For all three occupations Census and CPS provide continuous estimates of total supply, and Census provides estimates by employment setting. Consistent estimates of the supply of dental assistants, both total and by employment setting, are also available on a continuing basis from BLS, while for dental hygienists and dental laboratory technicians, HRA provides estimates of total supply for 1977. This occupational cluster is one for which existing data sources are adequate for estimating work force supply.

Table 5.6. Estimated Supply of Active Dental Laboratory Technicians by Employment Setting and Data Source

	Data Source		
Employment Setting	HRA (1977)	CPS (1979)	Census (1970)
Total	45,100	43,000	26,608
Dentists' Offices			4,431
All Others			22,177[1]

[1] Includes 18,451 in the category, "Health Services, Not Elsewhere Classified." This category includes dental laboratories.

Table 5.7. Consistency of Estimates of Active Dental Laboratory Technicians

Data Source	Coverage	Periodicity	Consistency of Estimate
HRA	Registered and Nonregistered Dental Laboratory Technicians, Total Supply	1977	Consistent with other sources for total supply.
Census	Registered and Nonregistered Dental Laboratory Technicians, Total Supply and by Employment Setting	Decennial, most recently in 1970	Consistent with other sources for total supply.
CPS	Registered and Nonregistered Dental Laboratory Technicians, Total Supply	Annual, most recently in 1979	Consistent with other sources for total supply.

REQUIREMENTS FOR DENTAL AUXILIARY SERVICES PERSONNEL

The derivation of appropriate criteria to indicate requirements for dental hygienists, dental assistants, and dental laboratory technicians was conducted in several phases: (1) interviews with knowledgable professionals to identify factors affecting current and future supply of personnel for these auxiliary services; (2) evaluation of the consistency and availability of data on supply of each profession; (3) development of recommendations for estimating current and future requirements for personnel in these services; and (4) construction of personnel-to-population ratios for each profession, using the most reliable data available.

Interviews with Dental Auxiliary Services Personnel

A full description of the purpose, structure, and methodology used in the interviews was provided in Chapter 2. In this section is presented: (1) a description of the interviewees; (2) results obtained; and (3) a discussion of implications.

Description of Interviewees: In order to obtain first-hand information on factors determining the level of requirements for dental auxiliary personnel, telephone interviews were conducted with a small sample of individuals who were selected as being knowledgeable on these issues, as well as having a general familiarity with the state of the profession and trends likely to affect its future.[9] An attempt was made to ensure a representative diversity of views, by contacting individuals affiliated with the relevant professional organizations and with occupational training programs, as well as employers and supervisors and practitioners themselves. In order to represent inter-area differences in practice structure, market conditions and legislative factors, an attempt was made to select a geographically diverse interview sample; however, given the restriction on the number of interviews (the sample size was limited to nine), attainment of this objective was not fully possible. Table 8 depicts the distribution of the dental auxiliary interviewees by background and geographic region. It must be pointed out that while each interviewee was selected primarily as representing one of the categories of professional background, some members of the sample overlapped into more than one category. For instance, it was not uncommon for an interviewee affiliated with one of the professional associations to have had some past or current involvement with occupational training programs; in such cases, the information provided during the interview could shed light on both the association and the academic perspective, thus increasing the effectiveness of the limited interviewing effort. As shown in table 8 two of the interviewees were classified as practitioners. Of these two, one is a dental hygienist practicing in California, while the other is a dental assistant in Georgia. In addition to the differences in their occupations and locations, the hygienist has been working in general practice for less than a year, while the assistant has almost ten years' experience and is working for a periodontist.

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[9] A more detailed description of the interview process is contained in Chapter 2.

Two interviews were conducted with individuals classified as employers or supervisors of dental auxiliary personnel. As in the case of the practitioners, these two individuals represent widely different outlooks: one is a dentist who has a general practice in Kentucky, while the other supervises a commercial dental laboratory in Massachusetts.

Table 5.8. Matrix of Characteristics of Dental Auxiliary Cluster Interviewees

	GEOGRAPHIC REGION			
CATEGORY	NORTHEAST	NORTH CENTRAL	SOUTH	WEST
Association		XXX		
Education		X	X	
Employer	X		X	
Practitioner			X	X

Individuals concerned with the training of dental auxiliaries were represented in two additional interviews. These interviews focused especially on the issues of accreditation standards and the role of dental auxiliaries in the provision of dental care.

Finally, representatives of three professional associations for dental auxiliaries were interviewed: one individual each from the American Dental Hygienists Association, the American Dental Assistants Association, and the National Dental Hygienists Association. Of these three individuals, only one had a professional background in dental auxiliary services prior to her current position.

Results: The nine interviews conducted with individuals in the dental auxiliary field yielded a substantial amount of information on the nature of the field itself, as well as suggesting a set of factors which might be used to estimate work force requirements. Although the data collected were qualitative rather than quantitative in nature, the insights they provide are useful in forming an analytical foundation for future efforts in this direction. Topics covered during the interviews included the following:

- the individual's background, experience, and current employment setting;
- a description of professional training programs and related training and credentialing issues;
- an assessment of job opportunities, including geographic factors and predominate employment settings;
- the relationships between dental auxiliary occupations, and their role in the provision of dental care; and
- an observation of current and future trends in dental auxiliary services, and how they might influence personnel requirements.

As indicated by the description above, each interviewee provided a unique outlook on these issues and, despite the diversity of backgrounds and experience, a number of general inferences may be drawn from their responses.

One observation which was shared by almost all of those interviewed was that the overall supply of dental auxiliary personnel is at least adequate. However, a few important exceptions to this situation were noted:

- there appears to be a shortage of personnel in the central cities and rural areas; and
- highly qualified personnel may be in short supply, even when the overall supply is adequate--this seems especially true in the cases of dental assistants and dental laboratory technicians, for which certification is not mandatory.

Large northeastern metropolitan areas appear to have surpluses of dental auxiliary personnel.

The rapid growth in the number of dental auxiliary training programs appears to be declining, and the applicant pool from which these programs draw students is becoming smaller, according to the interview respondents. A few interviewees pointed out that the decline in applications is consistent with the experience of most postsecondary programs, and is not restricted to dental auxiliary training. However, this decline in new trainees, at a time when rapid changes are taking place in the field, may have implications for the future supply of qualified personnel.

The general consensus among those interviewed is that salary levels are lower than they should be, especially for dental assistants. Competition between trained and untrained assistants appears to be keeping salaries low in that market, and there were suggestions that more qualified hygienists and technicians, as well, were especially underpaid. In areas with extreme shortages of personnel, however, salary levels seem to adjust, if slowly, to market conditions.

Factors Affecting Needs-Based Estimates. The medical needs-based approach to estimating health manpower requirements can be thought of as the estimation of an "ideal" number of health professionals--that is, the number that would be needed to serve the population in a given area if all health care conditions which are determined to require treatment were, in fact, treated. To that extent, the resulting estimates serve as an upper bound for estimating personnel requirements, in that they are independent of market conditions which might restrict utilization.

The nature of dental care distinguishes it somewhat from other health care services, in that it is largely a "discretionary" service. That is, barring unusual circumstances, the consumer has a choice of whether or not to purchase dental care, to a much greater extent than he or she would be able to determine how much surgical care, for example, was to be purchased; thus, the characteristic which distinguishes most health care from other purchases is not as prevalent in the case of dental care.

One factor which does determine the overall need for dental care is the changing age-composition of the population. Over time, the proportion of people who are over 65 years of age is rising steadily. This increase in the elderly population may generate a greater need for dental auxiliary services, especially those provided by dental laboratory technicians, who must construct the dentures, bridges, etc., more commonly required by older people.

Technical changes in dental auxiliary services do not appear to be taking place at a rate comparable to that seen in some other types of health care (e.g., radiological services). As these changes do take place, they may affect the need for dental auxiliary personnel, although no such changes were specified by the interviewees.

Factors Affecting Demand-Based Estimates. The demand-based approach is one which describes the number of health professionals desired to care for a given population, as derived from specified assumptions about services demanded and work force productivity. Calculations may account for changes in technology, health insurance coverage, composition of the population, utilization of allied health personnel, and similar market and productivity-related factors.

A number of demand-based requirements factors were discussed during the interviews. Since the demand for dental auxiliary personnel is a derived demand--that is, consumers don't usually demand dental auxiliary services directly--two sets of factors enter into consideration: first, any factor which determines the demand for dental care, in general, affects the demand for dental auxiliary services; in addition, however, the demand for dental auxiliary services depends on the amount and mix of those services required (or desired) by dentists to produce a given amount of dental care.

Among the general determinations of the interviews were:

- demand appears to be rising, as the public becomes more aware of the role of dental care in improving health status;
- as incomes rise, discretionary services such as dental care become increasingly popular; and
- insurance coverage, which reduces the cost of care to the consumer, is rapidly expanding in the dental care sector, reducing economic barriers to acquisition of such care (however, some interviewees noted that the resultant increase in demand is less than had been expected).

On the production side:

- dentists are making increasing use of auxiliary personnel, as they become more aware of their usefulness, through training and experience;
- the ability of auxiliaries to perform expanded functions (resulting both from changes in training and new legislation) has increased their productivity, and thus their value to potential employers--this trend, moreover, seems likely to continue;
- however, great increases in the productivity of the dental care sector appear to be outstripping the concurrent increases in demand in most areas--thus, while shortages remain in the inner cities and rural areas, other areas may be experiencing oversupplies, especially of noncertified assistants.

In addition, the supply of dentists in an area is bound to affect the demand for dental auxiliary services: if there are few dentists in an area, there will likely be few settings in which dental auxiliaries can find employment; on the other hand, however, in areas with an oversupply of dentists, some services usually performed by dental auxiliaries may be performed by dentists.

Other Considerations. In addition to the above-mentioned factors, several other concerns were expressed by the interview respondents. One concern was over the wide variation in credentialing requirements from state to state, especially for dental assistants. This situation has two implications for the provision of dental care: first, the lack of requirements makes it difficult to be sure if the services provided are of the quality desired; second, the competition between certified and noncertified assistants, and the concomitant low salaries, make it more difficult to attract qualified practitioners into the field.

Another concern expressed during the interviews was with the high turnover rate in all three dental auxiliary occupations. This high turnover was seen to stem from two characteristics of the dental auxiliary profession: first, the predominance of women in the dental hygiene and dental assistant fields has historically meant that more personnel leave the field to marry and establish families--this tendency has declined in recent years, as it becomes more common for women to have careers; second, the low salary levels paid to dental auxiliaries make it hard for employers to keep qualified and experienced personnel. Although the turnover rate appears to have declined recently, as economic conditions reduce the availability of alternate means of employment, it remains an important factor in estimates of personnel requirements.

Note must also be taken of the relationships between the occupations; the expansion of functions and an increasing movement on the part of hygienists to establish independent practices may change the current interrelationships.

Finally, the role of minorities in the dental auxiliary fields was covered in the interviews. It was pointed out that the shortage of dental care personnel in the inner cities reflect the need for more minority personnel, since these individuals are more likely to locate in the areas where the shortages exist.

Summary: As shown by the previous discussion, the issues involved in estimating requirements for dental auxiliary personnel are complex and not easily quantifiable. However, the interview results also serve to point out that it is possible to gain a deeper understanding of these issues by soliciting the expert opinions of those involved in the various aspects of the dental auxiliary field. A summary of the major issues is presented in table 5.9.

Table 5.9. Summary of Major Findings from Interviews with Dental Auxiliary Professionals

ISSUE	FINDINGS
Overview	The supply of dental auxiliary personnel is at least adequate; however, there are shortages in some areas, notably the inner cities and rural areas.
	The rapid growth in the number of dental auxiliary programs seems to be declining and the number of applicants to these programs is declining.
	Salary levels for dental auxiliary personnel tend to be low, which presents problems in terms of attracting new personnel and keeping present personnel from leaving the field.
Need Factors	An increase in the number of elderly people has increased the need for certain types of dental care, especially the services provided by dental laboratory technicians.
	Technical change was not cited as a factor in developing requirements for dental auxiliaries.
Demand Factors	Increasing public awareness of the need for dental care has increased the demand for such care.
	Rising incomes have made consumers more willing to purchase dental care, since it is a relatively discretionary service.
	Although third-party coverage of dental care services has rapidly increased in recent years, the resulting expansion of demand has not been as great as was anticipated.
	There is a trend toward four-handed dental practice, increasing the requirements for dental auxiliary personnel.

Table 5.9. (Continued)

ISSUE	FINDINGS
	o Dental auxiliaries are being trained to perform an increasing number of services (expanded functions) increasing their usefulness to potential employers.
	o The increasing productivity of dental care appears to be outstripping the growth in demand, creating oversupplies in some areas.
	o The supply of dentists can be expected to have a direct effect on dental auxiliary demand.
Other Considerations	o Variation in credentialing requirements, especially for dental assistants, makes it difficult to assure that high quality services will be maintained.
	o The high turnover rate in the profession has traditionally ensured that positions are continually available, but this turnover rate is declining.
	o Minority personnel may be required to provide dental care in some areas to improve access to services.
	o Increasing numbers of males are entering the traditionally female field of dental hygiene, as sex role barriers to employment are removed.

The need for further research in the area of work force requirements estimation centers around three major issues:

- first, there appears to be a need for a comprehensive work force survey to ascertain the number of personnel who are active in each occupation, their distribution by geographic area, and the extent of training and/or certification;
- second, further study needs to be made of the growth in popularity of four-handed dentistry, and the expanded functions performed by dental auxiliaries in terms of the implications for productivity and work force requirements; and
- in addition, the effectiveness of market incentives (salary differentials, etc.) in correcting short-run problems of maldistribution must be further investigated.

Other issues which should be considered include estimates of the existing need for services, inconsistencies in credentialing requirements, determinants of the demand for dental care, and the interaction of the various types of dental health personnel.

Finally, it should be recognized that the factors explicitly considered in this section do not represent a complete list. Other factors must be considered in developing dental auxiliary work force requirements. A full discussion of the relevant analytical and methodological issues is presented below in the separate occupation-specific sections.

Recommendations for Estimating Requirments for Dental Auxiliary Personnel

Dental Hygienists

Estimating Current Requirements for Dental Hygienists: The general recommendation proposed in Chapter 2 of this report is that a personnnel-to-population ratio approach be used to establish current requirements estimates. The review of definitional considerations and of data availability suggests that this is a feasible recommendation for this occupation. Consequently, the following specific recommendations for estimation of current requirements for dental hygienists are suggested:

> Recommendation 1: State-level personnel-to-population ratios should be constructed using the 1977 HRA data, Census, or CPS household survey data for licensed dental hygienists.

Recommendation 2: Determination of a standard of adequacy for the dental hygienist-to-population ratio should be made. A national mean or a state median value may be selected. As use of a national average would incorporate existing shortages into the requirements estimate, it is recommended that determination of the standard of adequacy take account any existing evidence on the presence of a geographical shortage (e.g. number of job vacancies, rate of increase in salary levels).

Recommendation 3: Use of the dental hygienist-to-population ratio standard of adequacy to assess whether identified geographic regions have sufficient numbers of hygienists to meet existing requirements should take into account characteristics of these subnational regions in determining whether an excess or shortage of dental hygienists exists. Specifically, consideration should be given to the presence of employment settings in which dental hygienists may be employed (e.g. dentists' offices, schools, hospital clinics, public health departments, and military installations).

Estimating Future Requirements for Dental Hygienists: The dental hygienist-to-population ratio and the standard of adequacy selected to estimate current requirements for dental hygienists will provide the basis for estimation of future requirements. One alternative approach to estimating future requirements is to assume that the dental hygienist-to-population ratio standard of adequacy represents the minimum level of future requirements. Therefore, projected increases in the population require that proportional increases in the numerator of the ratio occur. This approach has the advantage of simplicity but fails to take into account factors other than population growth which may be expected to affect requirements for dental hygienists in the future.

Interviews with individuals knowledgeable of the dental auxiliary field focused, to a great extent, on factors which are expected to affect requirements for the profession in the future. A summary of the findings from the dental auxiliary interviews has been provided in table 9. Review of this information has resulted in the development of the following recommendations for determining future requirements for dental hygienists:

Recommendation 4: The standard of adequacy of the dental hygienist-to-population ratio selected for the estimation of current requirements should be used as the foundation for the development of estimates of future requirements for dental hygienists. Projections of future population size from the U.S. Bureau of the Census can be used to establish the denominator of the future ratio and the numerator (i.e., required number of dental hygienists to provide a constant level of services to the future population) can then be constructed.

Recommendation 5: Refinements of the estimate of future requirements for dental hygienists should take into account the factors indicated in table 9, to the extent possible. While the direction of the effects of such factors on requirements may be clear, the magnitude of the impact has not been determined. Consequently, it is recommended that professional opinions be sought prior to attempting to refine the ratio to permit adjusted future requirements to be calculated.

The importance of many factors, including population change, on future requirements is directly a function of the time interval over which future requirements are to be estimated. The input of expert opinion into estimates of future requirements becomes more critical the further into the future for which projections are to be developed. In all cases, it is clear that estimate of future requirements demands that judgmental decisions be made.

Dental Assistants

Estimating Current Requirements for Dental Assistants: The review of definitional considerations and of data availability suggest that construction of a personnel-to-population ratio is a feasible recommendation for this occupation. Consequently, the following specific recommendations for estimation of current requirements for dental assistants are suggested:

Recommendation 1: It is recommended that estimates of current requirements be constructed for the total supply of credentialed and noncredentialed dental assistants. The occupation is better defined functionally than most occupations, and data availability and quality is greater for the total supply than for registered personnel only. Use of 1980 census data, when available, may produce the most up-to-date estimates of requirements.

Recommendation 2: Determination of a standard of adequacy for the dental assistant-to-population ratio should be made, using a national or a median value. Since use of a national average would incorporate existing shortages into the requirements estimate, consideration should be given to factors which may indicate the existence of current shortages or excesses in establishing a standard of adequacy.

Recommendation 3: Use of the ratio standard to assess the adequacy of supply in subnational geographic areas should take into account the specific characteristics of the region, with particular attention to employment settings in which dental assistants may work (e.g. dentists' offices, dental schools, military dental clinics, and public health clinics).

Estimating Future Requirements for Dental Assistants: The dental assistant-to-population ratio standard and the standard of adequacy selected to estimate current requirements will provide the basis for estimation of future requirements.

One approach to estimating future requirements is to assume that the dental assistant-to-population ratio standard of adequacy represents the minimum level of future requirements. Therefore, projected increases in the population require that proportional increases in the numerator of the ratio occur. This approach has the advantage of simplicity but fails to take into account factors other than population growth which may be expected to affect requirements for dental assistants in the future.

Interviews with individuals knowledgeable of the dental auxiliary field focused, to a great extent, on factors which are expected to affect requirements for the profession in the future. Those factors (table 9) have resulted in the development of the following recommendations for determining future requirements for dental assistants:

> Recommendation 4: The dental assistant-to-population standard of adequacy should be used as the foundation for development of future estimates. As noted, projections of future population size from the U.S. Bureau of the Census can be used to establish the denominator of the future ratio and the numerator (i.e. required number of dental assistants to provide a constant level of services to the future population) can then be constructed.
>
> Recommendation 5: Refinements of the estimate of future requirements should take into account the factors indicated in table 9, to the extent possible. While the direction of the effects of such factors on requirements may be clear, the magnitude of the impact has not been determined. Consequently, it is recommended that professional opinions be sought prior to attempting to refine the ratio to permit adjusted future requirements to be calculated.

As was mentioned above, the importance of many factors, including population change, on future requirements is directly a function of the time interval over which future requirements are to be estimated.

Dental Laboratory Technicians

Estimating Current Requirements for Dental Laboratory Technicians: The review of definitional considerations and of data availability suggests that construction of a personnel-to-population ratio is a feasible recommendation for this occupation. Consequently, the following specific recommendations for estimation of current requirements for dental laboratory technicians are suggested:

Recommendation 1: It is recommended that estimates of current requirements be constructed for the total supply of registered and nonregistered dental laboratory technicians. The occupation appears well defined by function and data availability and quality are greater for the total supply than for registered personnel only. Use of 1980 census data, when available, may produce the most up-to-date estimates of requirements.

Recommendation 2: Determination of a standard of adequacy for the dental laboratory technician-to-population ratio should be selected. Since use of a national average would incorporate existing shortages into the requirements estimate, it is recommended that determination of the standard of adequacy take into account any existing evidence on the presence of a current shortage (e.g. number of job vacancies, rate of increase in salary levels).

Recommendation 3: Use of the ratio standard to determine whether subnational geographic areas have adequate supply of dental laboratory technicians to meet current requirements should take into account such characteristics of the subnational region as the presence of employment settings in which dental laboratory technicians work (e.g. commercial laboratories, dentists' offices, dental school laboratories, faculty teaching positions).

Estimating Future Requirements for Dental Laboratory Technicians: The dental laboratory technician-to-population ratio and the standard of adequacy selected to estimate current requirements for the profession will provide the basis for estimation of future requirements for dental laboratory technicians. The following recommendations for determining future requirements for dental laboratory technicians have been developed:

> Recommendation 4: The standard of adequacy ratio selected for the estimation of current requirements for dental laboratory technicians should be used as the foundation for the development of estimates of future requirements. Projections of future population size from the U. S. Bureau of the Census can be used to establish the denominator of the future ratio and the numerator (i.e. required number of technicians to provide a constant level of services to the future population) can then be constructed.
>
> Recommendation 5: Refinement of the estimate of future requirements for dental laboratory technicians should take into account the factors indicated in Table 5.9, to the extent possible. While the direction of the effects of such factors on requirements may be clear, the magnitude of the impact has not been determined. Consequently, it is recommended that professional opinions be sought prior to attempting to refine the ratio to permit adjusted future requirements to be calculated.

As has been stressed for other occupations in this cluster, attention should be paid to the need for obtaining expert opinion input into estimates of future requirements for dental laboratory technicians. This is especially crucial for estimates which are constructed for long-term projections.

Personnel-to-Population Ratios

Thorough review of the information obtained during the conduct of the present study resulted in a conclusion that construction of personnel-to-population ratios for dental hygienists, dental assistants, and dental laboratory technicians was feasible, both at the national level and at the state-level. These estimates are presented in tables 5.10, 5.11, 5.12 and 5.13.

Table 5.10. National Personnel-to-100,000 Population Ratios, Dental Auxiliary Occupations, 1970

Occupation	Total Supply, 1970	Personnel-to-100,000 Population
Dental Hygienists	15,805	7.8
Dental Assistants	88,175	43.4
Dental Laboratory Technicians	26,608	13.1

SOURCE: U.S. Bureau of the Census, 1970 Census of Population.

Table 5.11. Dental Hygienists-to-100,000 Population, by State, 1970

State	Number of Employed Dental Hygienists	Personnel-to-100,000 Population
Alabama	512	14.9
Alaska	9	3.0
Arizona	138	7.8
Arkansas	65	3.4
California	1,847	9.2
Colorado	191	8.6
Connecticut	688	22.7
Delaware	47	8.6
District of Columbia	119	15.7
Florida	641	9.4
Georgia	471	10.3
Hawaii	23	3.0
Idaho	25	3.5
Illinois	452	4.1
Indiana	312	6.0
Iowa	128	4.5
Kansas	168	7.5
Kentucky	101	3.1
Louisiana	87	2.4
Maine	101	10.2
Maryland	265	6.8
Massachusetts	1,072	18.8
Michigan	861	9.7
Minnesota	356	9.4
Mississippi	51	2.3
Missouri	155	3.3
Montana	10	1.4
Nebraska	64	4.3
Nevada	28	5.7
New Hampshire	122	16.5

Table 5.11. (Continuted)

State	Number of Employed Dental Hygienists	Personnel-to-100,000 Population
New Jersey	447	6.2
New Mexico	48	4.7
New York	2,242	12.3
North Carolina	238	4.7
North Dakota	26	4.2
Ohio	608	5.7
Oklahoma	117	4.6
Oregon	169	8.1
Pennsylvania	749	6.4
Rhode Island	91	9.6
South Carolina	134	5.2
South Dakota	25	3.8
Tennessee	190	4.8
Texas	452	4.0
Utah	56	5.3
Vermont	55	12.4
Virginia	213	4.6
Washington	329	9.6
West Virginia	86	4.9
Wisconsin	405	9.2
Wyoming	16	4.8

SOURCE: U.S. Bureau of the Census, 1970 Census of Population.

Table 5.12. Dental Assistants-to-100,000 Population, by State, 1970

State	Number of Employed Dental Assistants	Personnel-to-100,000 Population
Alabama	1,145	33.2
Alaska	83	27.7
Arizona	842	47.5
Arkansas	561	29.2
California	13,270	66.5
Colorado	1,143	51.8
Connecticut	1,331	43.9
Delaware	224	40.9
District of Columbia	279	36.9
Florida	2,854	42.0
Georgia	1,369	29.8
Hawaii	467	60.7
Idaho	333	46.7
Illinois	4.177	37.6
Indiana	1,764	34.0
Iowa	1,013	35.9
Kansas	1,119	49.8
Kentucky	878	27.3
Louisiana	929	25.5
Maine	247	24.9
Maryland	1,694	43.2
Massachusetts	3,139	55.2
Michigan	4,288	48.3
Minnesota	1,981	52.1
Mississippi	579	26.1
Missouri	1,733	37.0
Montana	193	27.8
Nebraska	775	52.2
Nevada	233	47.6
New Hampshire	277	37.5

Table 5.12. (Continued)

State	Number of Employed Dental Assistants	Personnel-to-100,000 Population
New Jersey	3,602	50.2
New Mexico	351	34.5
New York	8,443	46.3
North Carolina	1,740	34.2
North Dakota	161	26.0
Ohio	4,164	39.1
Oklahoma	1,041	40.7
Oregon	1,406	67.2
Pennsylvania	3,442	29.2
Rhode Island	376	39.7
South Carolina	702	27.1
South Dakota	288	43.2
Tennessee	1,295	33.0
Texas	4,693	41.9
Utah	670	63.3
Vermont	175	39.4
Virginia	1,940	41.7
Washington	2,419	71.0
West Virginia	478	27.4
Wisconsin	1,721	39.0
Wyoming	148	44.6

SOURCE: U.S. Bureau of the Census, 1970 Census of Population.

Table 5.13. Dental Laboratory Technicians-to-100,000 Population by State, 1970

State	Number of Employed Dental Laboratory Technicians	Personnel-to-100,000 Population
Alabama	288	8.4
Alaska	35	11.7
Arizona	256	14.4
Arkansas	136	7.1
California	4,321	21.6
Colorado	260	11.8
Connecticut	359	11.8
Delaware	35	6.4
District of Columbia	148	19.6
Florida	1,050	15.5
Georgia	451	9.8
Hawaii	67	8.7
Idaho	70	9.8
Illinois	1,514	13.6
Indiana	526	10.1
Iowa	303	10.7
Kansas	273	12.1
Kentucky	200	6.2
Louisiana	346	9.5
Maine	54	5.4
Maryland	484	12.3
Massachusetts	842	14.8
Michigan	881	9.9
Minnesota	567	14.9
Mississippi	99	4.5
Missouri	696	14.9
Montana	46	6.6
Nebraska	195	13.1
Nevada	43	8.8
New Hampshire	72	9.8

Table 5.13. (Continued)

State	Number of Employed Dental Hygienists	Personnel-to-100,000 Population
New Jersey	1,299	18.1
New Mexico	66	6.5
New York	3,503	19.2
North Carolina	322	6.3
North Dakota	70	11.3
Ohio	1,096	10.3
Oklahoma	230	9.0
Oregon	283	13.5
Pennsylvania	1,509	12.8
Rhode Island	142	15.0
South Carolina	138	5.3
South Dakota	59	8.8
Tennessee	391	10.8
Texas	1,134	10.1
Utah	87	8.2
Vermont	6	1.4
Virginia	339	7.3
Washington	623	18.3
West Virginia	141	8.1
Wisconsin	506	11.4
Wyoming	47	14.2

SOURCE: U.S. Bureau of the Census, 1970 Census of Population

Chapter 6
Radiologic Technology

OVERVIEW OF THE PROFESSION

The field of radiologic technology involves the use of ionizing radiation and other types of radiation to provide diagnostic and/or therapeutic services. Originally, the field consisted almost entirely of technical assistants and X-ray technicians, whose sole purpose was to assist the physician in operating the required machinery. Now, as described by the Bureau of Health Professions (BHPr):

> New professions have emerged with medical advances and technological development in equipment and instrumentation. New applications of radioisotopes and radio-active drugs have expanded pharmaceutical services into radiology and led to the growth of nuclear medicine technology. The invention of therapeutic X-ray machines useful in the treatment of cancer led to the birth of radiation therapy technology and expanded scientific disciplines such as radiobiology. More recently, the development of ultrasound scanning and computerized tomography has led to the training of technological and instrument specialists.[1]

For the purposes of this study, three specific occupations within the field of radiologic technology are examined: radiographers; nuclear medicine technologists; and radiation therapy technologists.

Radiographers have been described as personnel who "...specialize in the use of X-radiation and other ionizing radiations in order to assist the physician in the diagnosis of disease or injury."[2] These practitioners, who once comprised the entire field of radiologic technology (when they were called "X-ray technicians"), are primarily responsible for the operation of X-ray equipment and the preparation of patients for various types of diagnostic procedures. These tasks are performed under the general direction of a physician (usually a radiologist). Their specific functions are described as follows:

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[1] U.S. DHEW, A Report on Allied Health Personnel. DHEW Publication No. (HRA) 80-28, 1979, p. XII-1.

[2] *Ibid*., p. XII-1.

> Radiographers prepare radio-opaque mixtures administered to patients so that internal organs may be observed and identified on film, position patients, adjust X-ray equipment to correct settings, and determine proper voltage, current, and exposure time for the production of radiographs. They assist the radiologist in fluoroscopic procedures and are responsible for maintaining equipment in proper working order, processing film, and keeping patient records. Although examinations are normally conducted in the hospital or a physician's office, radiographers are also capable of operating mobile X-ray equipment at the patient's bedside or in the hospital operating room.[3]

As is the case with other allied health practitioners, the specific responsibilities of the radiographer may vary by the state in which he or she is located, and by the setting in which the services are to be provided, as well as according to the individual physician responsible for the case.

Nuclear medicine technologists are involved in both diagnostic and therapeutic procedures. They prepare and use radioactive nucleides in laboratory procedures, scanning images, and function studies. Additional functions performed have been described as follows:

> Under the guidance of a nuclear medicine physician, the technologist receives, positions, and attends to patients, makes dose calculations for in vivo studies, performs a wide variety of diagnostic tests on human beings or on body fluids, and applies radioactive materials in treatment procedures. Nuclear medicine technologists are responsible for the safe disposal or storage of radioactive materials and for the inventory and control of radiopharmaceuticals.[4]

The majority of nuclear medicine technologists enter the field with previous education and/or experience as radiographers or medical technologists.

Radiation therapy technologists use X-ray and electron beam equipment in the therapeutic treatment of disease. This treatment, which is performed under the prescription and according to the instructions of a physician, involves the exposure of specific areas of the patient's body to the prescribed doses of ionizing radiation. In addition, radiation therapy technologists have the following responsibilities:

> They observe and report patient reactions, and assist in tumor localization and dosimetric procedures. They assist in maintaining the proper operation of controlling devices and equipment, observe safety measures for patients and clinical personnel, and may keep or

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[3] Ibid., p. XII-2.

[4] Ibid., p. XII-2.

share in keeping patient records, as well as assisting in the preparation and handling of radioactive materials used in treatment procedures.[5]

Many radiation therapy technologists also have previous education as radiographers or as registered nurses.

It appears that a majority of the work force in radiologic technology is made up of women, although more men appear to be entering the field. This influx of males into the profession may be due to two major factors:

- as technological change increases the volume and complexity of the functions performed by these personnel, it becomes more acceptable for men to enter the field;
- in addition, as salaries become comparable with those in other fields, more men are attracted to radiologic technology.

Moreover, as the classification of occupations by sex becomes less stringent, the field of radiologic technology becomes more open to male practitioners.

BHPr reports that there were 109,114 registered radiographers as of December 1978.[6] Indications are, however, that the actual number of radiographers may be much greater than that number. The number of active personnel is even more difficult to estimate, since at any given time up to one-third of all radiographers may be inactive. The estimate arrived at by BHPr was 95,000 active practitioners in 1978.[7] In addition, they estimated that about 6,500 nuclear medicine technologists and 2,500 radiation therapy technologists were active in 1978; many of these personnel may also be radiographers.

A sharp increase in the number of radiologic technology personnel in recent years has been noted,[8] with an average annual growth rate of about 13 percent in the number of radiographers from 1970 to 1978. However,

> the future is somewhat uncertain because several states have passed laws requiring a license to practice as a radiographer and additional states are considering licensure requirements... The result has been to impose stricter standards of practice, which has reduced the work force or threatens to do so. This

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[5] _Ibid_., p. XII-2.

[6] _Ibid_., p. XII-2

[7] _Ibid_., p. XII-3.

[8] _Ibid_., p. XII-3.

> is expected to have a significant impact on the number of practicing radiographers in future manpower projections.[9]

This issue is discussed in more detail below.

As pointed out in the preceding descriptions of allied health personnel and their functions, the specific responsibilities of each practitioner depend greatly on the practice setting in which the relevant services are provided. As might be expected from the nature of radiological services, the vast majority of practitioners are employed in hospitals or clinics, where the bulky and expensive equipment necessary for these services are most likely to be available.

Due to the complex and rapidly changing nature of the radiologic technology field, the issue of credentialing is an important one. Licensure requirements for radiographers are in effect or being implemented in a number of states. However, the qualifications required for licensure vary from state to state, as do the functions which radiographers are permitted to perform. Registration is conducted by the American Registry of Radiologic Technologists (AART), which examines and certifies the competency of candidates.

The licensing of nuclear medicine technologists is also conducted by the individual states, rather than on a national scale. In fact, since most nuclear medicine technologists have previous education as radiographers, there are few cases in which any distinction is made between them, for the purpose of licensure. Registration is primarily conducted by three organizations: the American Registry of Radiologic Technologists, the Board of Registry of the American Society of Clinical Pathology, and the Nuclear Medicine Technology Certification Board.

In the case of radiation therapy technologists, the licensing process is similar to those described above. All states which license other types of radiologic technology personnel also license radiation therapy technologists and, in general, make no distinctions among the occupations for licensing purposes. The American Registry of Radiologic Technologists, which administers a certification examination specifically for radiation therapy technologists, conducts a voluntary national certification program.

DEFINITIONAL CONSIDERATIONS

Prior to determining the supply or estimating requirements for radiologic technology personnel, it is essential that definition of each occupation be selected. Three occupations in the field are examined here. Consistent estimates of the total supply of the work force in radiologic technology are available at the cluster level. However, there is very little consistency among the estimates available for the individual occupations in this cluster.

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[9] *Ibid*., p. XII-3.

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Radiologic Technologists

Very little data are available on the individual occupations in this cluster, but estimates are available on the cluster level. As a result, any evaluations which can be made of occupation specific estimates must be based on comparison with cluster level estimates. For this reason, the sources of data on all radiologic technologists are discussed first, and sections dealing with individual occupations will follow.

There is no consistency in the definitions used in the data sources examined to identify individual occupations within this cluster. The term "radiologic technologists" has, in different sources, been used to refer to the entire cluster, to radiographers only, and to those in the cluster who are neither radiographers nor nuclear medicine technologists (presumably, radiation therapy technologists). Radiographers (as defined above) have been referred to as "radiographers," "X-ray technologists," "radiologic technologists," and "radiographic technologists." It also appears that "radiographers" has been used to refer to the entire cluster in some instances. Consequently, it is difficult to determine what definition is applied in some cases.

For the remainder of this chapter, "radiologic technologists" will be used for all professionals in the cluster, except when explicitly discussing one of the data sources' use of the term. The occupational titles will be those specified at the beginning of the chapter.

Another definitional problem arises out of the fact that it is possible, even likely, that many workers in the cluster qualify for classification in more than one occupation. Most nuclear medicine and radiation therapy technologists have previous experience as radiographers. There is even evidence that, on occasion, individuals perform the functions of more than one of the occupations.

Although a substantial majority of all radiologic technologists are registered, the credentialing system provides little help in distinguishing between the three occupations in the cluster. The American Registry of Radiologic Technologists (ARRT) awards the credential Registered Technologist (RT) with a one letter suffix of R, T, or N for radiographers, radiation therapy technologists, or nuclear medicine technologists, respectively, and there is evidence that individuals may be registered in more than one of the fields.

In summary, there are many definitional issues of concern when attempting to determine the supply or estimating requirements for radiologic technologists. Examination of titles may not help in determining the population included in an estimate. For this reason, all of the data sources on supply of radiologic technologists, even those which seem to include only a portion of the cluster, are included in Table 6.2. A separate examination of radiography is presented in this section. Radiographers have been described as personnel who

"...specialize in the use of X-radiation and other ionizing radiations in order to assist the physician in the diagnosis of disease or injury."[10] These practitioners, who once comprised the entire field of radiologic technology (when they were called "x-ray technicians"), are primarily responsible for the operation of x-ray equipment and the preparation of patients for various types of diagnostic procedures.

As is the case with other allied health practitioners, the specific responsibilities of the radiographer may vary by the state in which he or she is located, and by the setting in which the services are to be provided, as well as according to the individual physician responsible for the case.

Radiographers: Prior to estimation of supply and requirements for radiographers, it will be necessary to select a definition of the population of radiographers to be considered. Two alternatives are proposed:

(1) "Radiographers" can be defined as those who are employed and who are Registered Technologists-R under the standards provided by ARRT; or

(2) "Radiographers" can be defined as those persons who are employed to perform the functions of a radiographer.

In either case, the definition should exclude those persons who are specializing in radiation therapy or nuclear medicine, even though they may be trained and have been credentialed as RT-R prior to specialization.

Nuclear Medicine Technologists

Nuclear medicine technologists are involved in both diagnostic and therapeutic procedures. They prepare and use radioactive nucleides in laboratory procedures, scanning images, and function studies. The majority of nuclear medicine technologists enter the field with previous training and/or experience as radiographers or medical technologists.

As was the case for radiographers the definition of the population for this profession revolves around the issue of registered or nonregistered personnel. Two alternative definitions are suggested:

(1) "Nuclear medicine technologists" can be defined as those persons who are registered nuclear medicine technologists under the ARRT or other credentialing body standards; or

(2) "Nuclear medicine technologists" can be defined as all registered and nonregistered personnel functioning as nuclear medicine technologists.

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[10] Ibid., p. XII-1.

Radiation Therapy Technologists

Radiation therapy technologists use x-ray and electron beam equipment in the therapeutic treatment of disease. This treatment, which is performed under the prescription and according to the instructions of a physician, involves the exposure of specific areas of the patient's body to the prescribed doses of ionizing radiation. Many radiation therapy technologists also have previous training as radiographers or as registered nurses.

As was observed for the other occupations in this cluster, the definitional alternatives observed for this occupation involve registration status. These alternatives include:

(1) "Radiation therapy technologists" may be defined as those persons who are registered radiation therapy technologists under ARRT or other credentialing body standards; or

(2) "Radiation therapy technologists": can be defined as all registered and nonregistered personnel functioning as radiation therapy technologists.

SUPPLY OF RADIOLOGIC TECHNOLOGY PERSONNEL

Data sources were identified and assessed. Results and recommendations are discussed for each element of this cluster: radiologic technologists (an all-embracing term), radiographers, nuclear medicine technologists, and radiation therapy technologists.

Radiologic Technologists

Data Sources: There are three sources of data on the total supply of radiologic technologists. These sources are discussed below.

(1) Occupational Employment Statistics Survey (BLS). BLS collects data on two categories of radiologic technologists: persons who "apply roentgen rays and radioactive substances to patients for diagnostic purposes" and who "assist in treating diseased or affected areas of the body, under supervision of a physician, by exposing the area to specified concentrations of X-rays for prescribed periods of time;" and persons who "maintain and safely use equipment and supplies necessary to demonstrate portions of the human body on X-ray film or fluoroscopic screen for diagnostic purposes." The combination of these two categories is broad enough to include the entire radiologic technology cluster. BLS estimates include registered and nonregistered workers.

(2) Census of Population (Census). Census uses The Standard Occupational Classification (SOC) category "radiologic technologists and technicians." This category includes the three individual occupations of interest to this project and a few minor, more specialized occupations. Census makes no definitional distinction between registered and

nonregistered workers, and Census estimates are available by employment setting.

(3) Current Population Survey (CPS). The occupational classification is the same as that used by Census. Data from 1972 through 1979 have been examined in the current study.

(4) Survey of Hospital Staff (NCHS-SHS). Four radiologic occupational categories were included in this survey: "radiologic technician or technologist;" "nuclear medicine technician or technologist;" "radiation therapy technicians;" and "other radiologic personnel."

The estimates produced by those sources are presented in Table 6.1.

Data Assessment: The evaluation of the cluster level estimates for radiologic technology are summarized in Table 6.2. Although there is little consistency on the individual occupation level within this cluster, Census, CPS and BLS all present estimates on a consistently defined cluster level, and NCHS-SHS, while there is less clarity with regard to the inclusion of its categories, appears to agree with the other three. BLS, Census and CPS present consistent estimates of the total supply of radiologic technologists. The CPS estimates exhibit a fairly consistent growth trend (68,000 in 1972 to 104,000 in 1979). When this trend is extended back to 1970, the Census estimate of 52,230 is seen to be in agreement with the CPS estimates. The distribution of workers among the two major employment settings--hospitals and physicians' offices--is consistent between BLS and Census. BLS' preliminary, unpublished data show 73 percent in hospitals and 20 percent in physicians' offices while Census estimates are 75 percent and 15 percent, respectively. The NCHS-SHS estimate of employment in hospitals, however, accounts for a larger proportion of the CPS total estimate of 85,000 in the same year (1977). If the NCHS-SHS category, "other radiologic personnel," consists mainly of support workers and is subtracted from the NCHS-SHS total, then the remaining NCHS-SHS 1977 estimate accounts for a more consistent 71 percent of the CPS total. Both employer-based surveys and household surveys, then have been seen to produce reliable estimates of the number of persons employed in the radiologic technology cluster.

Summary and Recommendation: While consistent definitional alternatives and high quality supply estimates do not exist for the individual occupations in this cluster, consistent estimates are available on the cluster level. Therefore, the following recommendation is made for obtaining estimates of the entire cluster of radiologic technologists:

> Recommendation 1: It is recommended that CPS, BLS and Census be used to estimate the supply of all radiologic technologists.
>
> Recommendation 2: BLS and Census also provide consistent estimates by employment setting. It is recommended that these sources be used for estimating the employment setting distribution of all radiologic technologists.

Table 6.1. Estimated Supply of Active Radiologic Technologists by Employment Setting and Data Source[1]

	Data Source		
Employment Setting	NCHS-SHS (1977)	CPS (1979)	Census (1970)
Total		104,000	52,230
Hospitals	50,900 FT 9,700 PT		39,018
Private Offices			9,593
All Others			3,619

[1] BLS estimates do not appear because they were not available for publication at the time that this report was being prepared.

Table 6.2. Consistency of Estimates of Active Radiologic Technologists

Data Source	Coverage	Periodicity	Consistency of Estimate
BLS	Registered and nonregistered radiologic technologists, supply and by employment setting.	Triennial, most recently in 1978	Consistent with Census and CPS for total supply. Consistent with Census.
NCHS-SHS	Registered and nonregistered radiologic technologists in hospitals.	1977	Consistent with Census for hospitals.
Census	Registered and nonregistered radiologic technologists and technicians, by supply and by employment setting.	Decennial, most recent in 1970	Consistent with BLS for total supply and by employment setting. Consistent with CPS for total.
CPS	Registered and nonregistered radiologic technologists, total supply.	Monthly with annual averages most recently in 1979	Consistent with other estimates for total supply.

The necessity still remains, however, to develop methods for obtaining estimates on the individual occupation level. The individual occupations are discussed below.

Radiographers

Data Sources: Of the data sources discussed on the cluster level, two also produce estimates of the number of radiographers. In addition, there are three other sources of estimates of the supply of radiographers. These five sources are discussed below.

(1) Occupational Employment Statistics Survey (BLS). The BLS study includes an occupational category, "radiologic technicians and technologists." This title often refers more generally to the cluster as a whole rather than to radiographers. BLS defines this category, however, as including persons who "maintain and safely use equipment and supplies necessary to demonstrate portions of the human body on X-ray film or fluoroscopic screen for diagnostic purposes." This definition corresponds more closely to radiographers alone.

(2) Survey of Hospital Staff (NCHS-SHS). NCHS-SHS includes a similarly titled occupational category. This seems to be intended to include the same persons as are in the BLS category, but it is less clear than the BLS category, because the NCHS-SHS questionnaire did not include as explicit definitions as did BLS.

(3) Technologist Manpower (ACR-ASRT). This study was jointly conducted by the American College of Radiography and the American Society of Radiologic Technologists. The ACR-ASRT estimate of total active radiographers is based on a count of the number of certified radiographers in 1978. From this number total active radiographers were estimated by applying an assumed employment rate and an assumed ratio of certified to total personnel. This estimate is not produced on a periodic basis.

(4) Survey of Selected Hospital Staff (AHA). This survey collected data on the number of "X-ray technologists and technicians" employed in hospitals. The AHA defined the personnel as "persons responsible for using X-ray and fluoroscopic equipment for diagnostic uses, under the direction of a physician." This definition includes all radiographers, regardless of credential status. The estimate produced is for radiographers in the hospital setting only.

(5) Allied Health Employment Matrix (AHEM). AHEM included an estimate of the total number of "radiologic technologists," certified and noncertified. Although the term "radiologic technologists" is often used as a general term for all workers in the radiologic technology cluster, AHEM defines "radiologic technologists" as being "trained in the use of radiographic and fluoroscopic uses of X-rays for the diagnosis of disease or examination of injuries." This definition corresponds more closely with that for radiographers than with that for the cluster as a whole, since the other occupations in the cluster include some therapeutic uses of X-rays. The AHEM national estimate was constructed using data from 27

states representing two thirds of the nation's population and including at least one state from each Census region. Conversion to full-time equivalent employment and extrapolation to all employment settings (many states reported data for hospitals only) are based on available data from Texas.

The estimates produced by these sources are presented in Table 6.3.

Data Assessment: The evaluation of the estimates for radiographers is summarized in Table 6.4. There is little consistency among the estimates of the supply of radiographers. The AHEM 1976 estimate, when compared to the CPS cluster estimate for 1976 suggests that radiographers constitute 92 percent of all radiologic auxiliaries as compared to 86 percent in 1978 when calculated from preliminary, unpublished BLS data. This difference is understated, because AHEM's estimate is expressed in full-time equivalent terms, while the BLS estimate represents total workers. Adjusting for this difference would inflate the AHEM estimate to the point where it would clearly be inconsistently large compared to the BLS estimate for radiographers. It is possible that, although the AHEM definition of the occupation seems to include only radiographers, other occupations are actually picked up in the estimate. There is, however, far too much ambiguity in the AHEM definition and estimation process to make a meaningful judgment of the estimate.

Ambiguity of coverage also presents a problem in dealing with the ACR-ASRT estimate. This estimate is based on the number of registered radiographers. This estimate for radiographers only is larger than the CPS cluster estimate for the same year (1979). It is known that many radiographers become nuclear medicine technologists and radiation therapy technologists. However, even if this broader inclusion is taken into account, the ACR-ASRT estimate is too large as compared to the other estimates. The inconsistency of ACR-ASRT estimate could be related to the assumed ratios of registered to nonregistered radiographers and of active to all radiographers.[11]

Summary and Recommendations: Radiography is an occupation for which there is some definitional inconsistency and for which consistent supply estimates do not exist. It has been recommended that Census and BLS results be used to obtain estimates for the entire cluster. The following recommendations are offered in an attempt to permit the development of separate, verifiable estimates for radiographers.

> Recommendation 1: An attempt should be made to have the Bureau of the Census include the separate category of radiographer in their ongoing data collection efforts. Census and the Bureau of Labor Statistics currently provide continuous, reliable estimates for a number of allied health occupations. However,

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[11] A more detailed discussion of the ACR-ASRT estimation procedure can be found in Technologist Manpower, the Conjoint Committee on Technology Job Descriptions and Manpower Studies, the American College of Radiology and the American Society of Radiologic Technologists, April 1979.

Table 6.3. Estimated Supply of Active Radiographers by Employment Setting and Data Source[1]

	Data Source			
Employment Setting	ACR-ASRT (1979)	NCHS-SHS (1977)	AHEM[2] (1976)	AHA (1973)
Total	128,929		82,000	
Hospitals		42,700 FT 8,800 PT		36,819 (33,909)FTE

[1] BLS estimates do not appear because they were not available for publication at the time that this report was being prepared.

[2] Full time equivalent (FTE).

Table 6.4. Consistency of Estimates of Active Radiographers

Data Source	Coverage	Periodicity	Consistency of Estimate
ACR-ASRT	Registered and Nonregistered Radiographers, Total Supply.	1979	Inconsistent with other estimates for total supply.
BLS	Registered and Nonregistered Radiographers Total Supply and by Employment Setting.	Triennial, most recently in 1978	Inconsistent with other estimates for total supply.
NCHS-SHS	Registered and Nonregistered Radiographers in Hospitals.	1977	Inconsistent with AHA for hospitals.
AHEM	Registered and Nonregistered Radiographers, Total Supply.	1976	Inconsistent with other sources for total supply.
AHA	Registered and Nonregistered Radiographers in Hospitals.	1973	Inconsistent with NCHS-SHS for hospitals.

Census currently only collects data on the radiologic technology cluster level. BLS collects data on radiographers, but there is some definitional ambiguity in the data currently available for comparison with the BLS estimate.

Recommendation 2(a): A second approach to the development of separate estimates for radiographers is an indirect approach which would not require any further data collection. A first step would be to determine the number of multiple certifications among the occupations in the cluster (many nuclear medicine technolgists and radiation therapy technologists have previous certification as radiographers).

Recommendation 2(b): When the number of duplicate certificants is established, it will then be possible to determine the proportion of the certified technologist work force that is certified in nuclear medicine technology, and the proportion of the certified work force that is certified in radiation therapy technology. These ratios may then be applied to the estimates provided by the Bureau of Labor Statistics or the Bureau of the Census, which are known to provide consistent estimates of the number of employed radiologic technologists at the cluster level, to determine the total number of certified and noncertified nuclear medicine technologists and radiation therapy technologists from the total cluster estimate will provide an estimate of the supply of radiographers. Since the vast majority of radiologic technologists are certified, there should be little loss of precision using this approach to estimate the total number of certified and noncertified personnel in each of the occupations.

Nuclear Medicine Technologists

Data Sources: NCHS-SHS reports on the number of nuclear medicine technologists in hospitals. There are no other independent sources of estimates of the supply of nuclear medicine technologists, other than simple counts of the number of persons certified by the three certifying bodies mentioned above. Certification counts give no indication of the number of employed workers. In addition, multiple certification often occurs between the nuclear medicine technology certifying bodies as it does between certification in radiography and certification in nuclear medicine technology.

Data Assessment: There is no way to assess the reliability of either the certification counts or the NCHS-SHS estimate for hospitals, since no sources of comparable data exist. BLS reports data on two categories in the radiologic cluster. One of these categories is radiographers, and the other is "radiologic technologist and/or nuclear medicine technologist." This category includes other nonradiographer personnel in the cluster, as well as nuclear medicine technologists. All other data sources report data either on the cluster level, or for radiographers only.

Summary and Recommendations: There are no verifiable reliable estimates of the supply of nuclear medicine technologists. This is due, in part, to the lack of consistently adopted definitions for the individual occupations within the radiologic cluster. The following recommendations have been developed in an attempt to permit the development of estimates for the supply of nuclear medicine technologists:

Recommendation 1: An attempt should be made to have the Bureau of Labor Statistics and the Bureau of the Census include the separate category of nuclear medicine technologist in their ongoing data collection efforts. Both sources currently provide reliable, continuous estimates for a number of allied health occupations under investigation. However, neither source currently collects separate data on nuclear medicine technologists.

Recommendation 2(a): A second approach to the development of estimates for the individual occupations within the radiologic technology cluster is an indirect approach that would not require any further data collection. The first step would be to determine the number of individuals who have multiple certification within the field of nuclear medicine technology (three organizations currently certify nuclear medicine technologists) and also between the occupations of radiography, radiation therapy technology, and nuclear medicine technology. A recently completed study by the American College of Radiology and the American Society of Radiologic Technologists (which consisted of a survey of all radiologic technologists certified by the American Registry of Radiologic Technologists) may provide valuable assistance in this effort. To determine the number of individuals who hold multiple certificates in the field of nuclear medicine technology is more problematic. This would require the cooperation of the American Registry of Radiologic Technologists, the American Society of Clinical Pathologists, and the Nuclear Medicine Technology Certification Board.

Recommendation 2(b): When the number of duplicate certificants is established, it will then be possible to determine the proportion of the certified technologist work force that is certified in nuclear medicine technology, and the proportion of the certified work force that is certified in radiation therapy technology. These ratios may then be applied to the estimates provided by the Bureau of Labor Statistics or the Bureau of the Census, which are known to provide consistent estimates of the number of employed radiologic technologists at the cluster level, to determine the total number of certified and noncertified nuclear medicine technologists. Since the vast majority of radiologic technologists are certified, there should be little loss of precision using this approach to estimate the total number of certified and noncertified personnel in nuclear medicine technology.

Radiation Therapy Technologists

Data Sources: As was discussed above for nuclear medicine technologists, data sources on subspecialties within this cluster are limited. Only ARRT data on registered radiation therapy technologists and NCHS-SHS data on radiation therapy technologists in hospitals provide information on the supply of this profession. The ARRT is the only registering body for this profession, but multiple registration is still a possibility in that many radiation therapy technologists hold previous credentials as radiographers.

Data Assessment: As is the case for nuclear medicine technologists, it is not possible to assess the reliability of existing data, because comparable data are not available.

Summary and Recommendations: Radiation therapy technology is an occupation for which a consistently adopted definition does not exist and for which assessable data have not been collected. The following recommendations have been developed in an attempt to permit the development of estimates of the supply of radiation therapy technologists.

> Recommendation 1: As was suggested for the other occupations in this cluster, an attempt should be made to have the Bureau of the Census and the Bureau of Labor Statistics include the separate category of radiation therapy technologist.
>
> Recommendation 2: A second approach to the development of estimates for the individual occupations within the radiologic technology cluster is an indirect approach that would not require any further data collection. This approach is the same as that discussed as Recommendations 2(a) and 2(b) for both radiographers and nuclear medicine technologists.

Reliable, continuous data are available for radiologic technologists on the cluster level. Census, BLS and CPS produce reliable estimates for the total supply of radiologic technologists, and BLS and Census also present data by employment setting. The existing data on the individual occupations is less adequate. Estimates for radiographers are available from many sources, including BLS, but definitional inconsistencies make for little agreement between the estimates. Very little data exist on the other two occupations in the cluster other than certification data and NCHS-SHS data for hospitals. It seems clear that greater agreement is necessary on the way in which the cluster is to be categorized into individual occupations.

REQUIREMENTS FOR RADIOLOGIC TECHNOLOGY PERSONNEL

The derivation of appropriate criteria to indicate requirements for radiologic technology professionals was conducted in several parts: (1) interviews with knowledgable professionals to identify factors associated with current and future requirements for such professionals; (2) evaluation of the consistency and availability of data on the supply of each profession, and (3) development of recommendations for estimating current and future requirements for radiologic technology professionals.

Interviews with Radiologic Technology Personnel

A full description of the purpose, structure, and methodology used for the interviews has been provided in Chapter 2. In this section is presented a description of the selected interviewees, a summary of results, and a discussion of implications.

Description of Interviewees: In order to obtain first-hand information on factors determining the level of requirements for radiologic technology personnel, telephone interviews were conducted with a small sample of individuals who were selected as being knowledgeable on these issues, as well as having a general familiarity with the state of the profession and trends likely to affect its future. An attempt was made to ensure a representative diversity of views, by contacting individuals affiliated with the relevant professional organizations, occupational training programs, employers and supervisors, and practitioners themselves. In order to represent interarea differences in professional functions, market conditions and legislative factors, an attempt was made to select a geographically diverse sample, as well. However, given the restriction on the number of interviews which could be conducted (the sample size was limited to nine), the simultaneous attainment of these objectives was not always possible. Table 5 depicts the distribution of the radiologic technology interviewees by background category and geographic region. It should be noted that, while each interviewee was selected primarily as representing one of the categories of professional background, some members of the sample overlapped into more than one professional category. For example, each of the association representatives in the interview sample was trained as a radiographer; moreover, individuals affiliated with hospital-based training programs frequently also function as supervisors of radiologic technologists. In such cases, the information provided during the interview could shed light on the relevant issues from multiple perspectives, thus enhancing the effectiveness of the limited interviewing effort.

As shown in Table 6.5., two of the interviewees were classified primarily as practitioners. One of these is a radiographer employed in a large corporation's medical services department, providing routine radiological services as part of required physical exams for new and current employees, as well as basic emergency services for those injured on the job; he is located in Wisconsin. The other practitioner included in the sample has worked for 18 years at the same private radiology practice in Arizona; in addition, she is involved in the local Health Service Agency.

Two of the interviewees are categorized as employers or supervisors. One of these individuals is Director of Radiology at a large medical center in Colorado, while the other is associated with the American College of Radiology, a medical specialty society composed of radiologists and physicists in radiology, radiation therapy, nuclear medicine, and ultrasound. The latter individual, although not trained in radiology, is familiar with the concerns of those who employ radiologic technology personnel; in addition, he has been involved in work force and training issues while associated with the ACR.

Table 6.5. Matrix of Characteristics of Radiologic Technology Cluster Interviewees

	GEOGRAPHIC REGION			
CATEGORY	NORTHEAST	NORTH CENTRAL	SOUTH	WEST
Association		XX		
Education			XX	X
Employer			X	X
Practitioner		X		X

The three representatives of the academic sector are also somewhat diverse in their backgrounds. One is Director of the Radiologic Technology Program at a large hospital in California, where students receive training in radiography and radiation therapy; he was trained himself as a radiographer, and has been involved in training for 15 years. Another of the interviewees serves as Clinical Coordinator for a community college-based program for radiographers and nuclear medicine technologists located in Florida. She has been a radiographer for over 20 years, and in her present position for the past eight years. The third individual in this category is Chairman of the Department of Diagnostic Radiology at a university-affiliated hospital in Kentucky. He is a physician who has been involved in the teaching of radiologic skills for over 20 years.

In addition to the persons already described, two representatives of the American Society of Radiologic Technologists were interviewed. One of these is the President of the ASRT, who, in addition, is Director of a hospital-based school of radiologic technology in Iowa; the other is Director of Education for the ASRT, and has been there for five years, after serving as a practitioner and in the academic sector for over 20 years before that.

Results: The interviews which were conducted with the individuals described above yielded a subtantial amount of information on the nature of the radiologic technology field, as well as suggesting a number of factors which might be useful in estimating manpower requirements. Although this information tended to be qualitative, rather than quantitative, in nature, the insights which they provide are useful in forming an analytical foundation for future efforts in requirements estimation. Topics covered during the interviews included the following:

- the individual's background, experience, and current employment setting;
- a description of professional training programs and related training and credentialing issues;
- an assessment of job opportunities, including geographic factors and predominate employment settings;
- the relationships between occupations in radiologic technology, and their role in the provision of health care; and
- an observation of current and future trends in radiology, and how these trends might effect personnel requirements.

As indicated by the descriptions above, each interviewee provided a unique perspective on these issues and, despite the diversity of backgrounds and experience, a number of general inferences may be drawn from their responses.

One impression that was common to those interviewed was that there is a shortage of radiologic technologists. This shortage appears to be especially severe in the newer occupations, such as radiation therapy technology. Moreover, a few of the interview participants mentioned that qualified personnel were in even shorter supply. The only exceptions to this situation seem to be the larger metropolitan areas and the northeast region, which were said to have adequate, if not excess, supplies of radiologic technology personnel.

The existence of a maldistribution such as that indicated above should call market forces into play to encourage the reallocation of personnel from surplus areas to those where shortages prevail. However, two factors brought to light during the interviews indicated that these market forces may not be operating appropriately:

- first, it was pointed out that there may be a lack of information about job opportunities in other areas--this would certainly hinder the desired redistribution of personnel;
- second, there appears to be a reluctance on the part of employers to raise salaries in areas which have manpower shortages--thus, the incentive to relocate is absent in these markets.

In addition to the problem of maldistribution, the overall shortage of personnel seems to be exacerbated by a sluggishness in the salaries of radiologic technologists.

Another factor which may account for the inability of market forces to adjust the supply and distribution of personnel is that the rapid changes in the field are creating new occupations (e.g., ultrasound) to perform the resulting new functions. To some extent, each of these new occupations comprises a new market, with separate adjustment mechanisms.

Thus, it may be inappropriate to speak of radiologic technology in general, where market forces are concerned.

The rapid changes taking place in radiology also have an effect on the training of radiologic technologists. As the level of technical knowledge required for entrance into the field rises, programs must adjust in both content and method. A trend toward competency based certification (aimed at ensuring technical competence) was observed by some of the interview participants. A few of those interviewed also pointed out that, in addition to the higher level of technical competence required, the increasing independence of radiologic technologists necessitates the acquisition of managerial skills, as well. Moreover, these increased educational requirements are taking place at a time when radiologic technology, along with many other professions, is experiencing a decline in applicants to professional educational programs.

Factors Affecting Needs-Based Estimates. The medical needs- based approach to estimating health manpower requirements can be thought of as the estimation of an "ideal" number of health professionals--that is, the number that would be needed to serve the population in a given area if all health care conditions which were judged as needing treatment were, in fact, treated. To that extent, it serves as an upper bound for estimating personnel requirements, since the resulting estimate would be independent of market considerations, such as the cost of services.

One factor which is particularly important in determining the need for radiology personnel is the rapid rate of technical change occurring in the field. At first, radiology was limited to the use of X-rays to help diagnose injuries and other illnesses. Over the years, it has expanded to include therapy as well as diagnosis, and the use of other types of ionizing radiation. In fact, the development of ultrasound techniques has expanded the field even beyond the limits of ionizing radiation. In addition, the development of computerized tomography represents an entirely new area of expertise required of radiology personnel. The effect of these changes on requirements is twofold:

- first, the number of personnel required to provide the expanding volume of radiological services is bound to increase rapidly; and
- second, the changing level of technical skills and knowledge required may mean that currently available personnel need additional training to keep their skills from becoming outmoded.

Thus, while the overall requirement for radiologic technology personnel will undoubtedly increase, a change in the mix of personnel may be required.

Recent changes have also affected the types of medical conditions which involve the application of radiological services. For instance, the ability to treat malignancies through radiation therapy has increased with advances in the relevant technology; thus, the volume of these services has increased with the increase in the incidence of those conditions.

As the population changes, the need for radiological services increases also. The trend toward delayed childbearing has made it more important to monitor the development of the fetus; since ultrasound plays a primary role in this type of care, the requirement for ultrasonographers is likely to rise. In addition, as the number of older people (who are especially subject to broken bones, etc.) in the population rises, the need for radiologic technologists is also expected to rise.

Factors Affecting Demand-Based Estimates. The demand-based approach is one which describes the number of health professionals desired to care for a given population, as derived from specific assumptions about services demanded and manpower productivity. These calculations should account for changes in technology, health insurance coverage, composition of the population, utilization of allied health personnel, and similar market and productivity-related factors.

The interviewees expressed an overall impression that the demand for radiologic technologists is increasing. This impression was based on a number of factors. First, the increased awareness on the part of the public of the role of radiological services has caused an increase in the volume of services provided. This awareness has been combined with a decrease in the financial burden of purchasing these services, as a vast majority of expenditures are made by third party payers (one interviewee estimated that 75 percent of the bill for radiological services is paid for by third parties). Moreover, as consumer incomes rise, their taste for higher quality services increases.

As demand for radiological services increases, physicians become more aware of the need for highly qualified technical personnel to help in providing these services. For example, the radiologist's function is usually limited to review and interpretation of the images produced by the radiographer; the radiologist may perform this function without ever having seen the patient. Thus, one interviewee estimated that, in about 85 to 90 percent of the procedures performed, the radiologist takes no active role. The relationship between the physician and the radiographer was described by one interviewee as analagous to that between the physician and the pharmacist.

Specialization also has an effect on the demand for radiologic technologists. As physicians become more specialized, auxiliary personnel become more necessary to the provision of services. The division of functions has been accompanied by an increase in specialization by radiologic technologists, which also serves to increase their productivity.

Other Considerations. In addition to the above-mentioned factors, several other concerns were expressed by the interview participants. One concern was over the problem of establishing professional standards. With the rate of technical change as high as it has been, the functions performed by practitioners in the field have expanded rapidly. In fact, as pointed out above, this technological change has created new occupations within the profession. This situation makes it difficult to ensure that the relevant personnel are adequately trained in the new procedures. There does seem to be a general pool of knowledge which most radiologic technologists have in common; for instance, 70 to 80 percent of all ultrasound personnel have received training as radiographers. There was some indication that radiographic training was sufficient in many cases as a general background for specific skills to be learned on the job.

The attrition rate in the profession was another concern expressed by the interview respondents; one interviewee estimated the turnover rate at 15 percent. This problem has serious ramifications in a market in which a shortage already exists. The reasons offered for this turnover rate include the following:

- since the majority of personnel in the field are women, many personnel leave to establish families;
- salaries are relatively low for the level of skills and training required; and
- opportunities in other related professions (equipment sales, etc.) are commonly available to radiologic technology personnel.

However, the attrition rate appears to be dropping, as worsening economic conditions cause a reluctance to change jobs, and social conditions make it more acceptable for women to pursue long-term careers.

Finally, the roles of women and minorities in the field appear to be changing, in the following ways:

- more women are attaining managerial positions within the field, in which they have traditionally been underrepresented and underpaid;
- a higher percentage of men are entering the field as practitioners, as pay disparities decrease and women find other job opportunities open to them; and
- more minorities appear to be entering the field.

These trends appear to be occurring more because of changes in social conditions than due to the overt efforts of any associations, programs, or individuals.

Summary: The issues described above indicate that the estimation of requirements for radiologic technology personnel is a complex matter, and that many of the considerations which must be made are not easily amenable to quantification. However, the interview results also serve to point out that it is possible to gain a deeper understanding of these issues by soliciting the expert opinions of those involved in the various aspects of training and practice within the field. A summary of the major issues is presented in Table 6.6.

Table 6.6. Summary of Major Findings from Interviews with Radiologic Technology Professionals

ISSUE	FINDINGS
Overview	o There is a severe and worsening shortage of personnel, especially in the new occupations.
	o Market forces, such as salaries and the availability of information, seem to be sluggish in adjusting to these shortages and any maldistribution which may occur.
	o The rapid rate of technical change in the field requires an adjustment in the training of personnel and their certification for practice.
Need Factors	o Technical change in radiology has also caused an increase in the need for qualified personnel to provide new and more advanced services.
	o An increase in the incidence of conditions in which radiological diagnosis and/or treatment is required has increased the need for personnel.
	o The changing makeup of the population suggests an even greater need for radiology personnel.
Demand Factors	o Increased awareness of the role of radiologic technology, both by the public and by physicians, has increased the demand for personnel.

Table 6.6. Continued

ISSUE	FINDINGS
	o Extensive coverage by third-party sources has decreased the financial barriers to acquiring these services.
	o As physicians become more specialized, radiologic technologists assume a greater role in providing radiological services.
Other Factors	o The high rate of technical change in the profession raises the issue of consistency of professional standards, especially in the new occupations.
	o There is a high attrition rate in the profession, due to low salaries and other factors, but this rate is declining.
	o The roles of women and minorities in the profession are changing as social and economic conditions change.

The need for further research in the area of work force requirements estimation centers around three major issues:

- first, there appears to be a need for a comprehensive work force survey, to ascertain the number of personnel who are active in the profession, their distribution by geographic area, and the extent of training and/or certification acquired--note must be made that the ASRT is planning a work force study;

- first, there appears to be a need for a comprehensive work force survey, to ascertain the number of personnel who are active in the profession, their distribution by geographic area, and the extent of training and/or certification acquired--note must be made that the ASRT is planning a work force study;

- second, further study needs to be made of the affects of technical change on the profession--its implication for educational requirements, job responsibilities, and the need for new personnel; and

- third, the effectiveness of market incentives (salaries, etc.) in attracting new personnel should be investigated in an attempt to deal with the severe and worsening shortage of radiologic technology personnel.

Other issues which should be considered include determinants of the need for radiological services and interactions between different types of personnel within the field.

Finally, it should be recognized that the list of factors explicitly considered in this section is not a complete list. Other factors must be considered in developing estimates of work force requirements. Recommendations for estimation of requirements for radiological technology personnel are presented in the separate occupation-specific sections which follow.

Recommendations for Estimating Requirements for Radiologic Technology Personnel

Radiographers

Review of Table 3 reveals that a number of estimates of radiographers are available, although it is uncertain whether the population in some cases is actual radiographers or whether the entire cluster is being surveyed. BLS collected data on radiographers and "radiologic and nuclear medicine technologists." The latter category seems to include all radiologic technologists who are not radiographers (i.e. radiation therapy technologists, nuclear medicine technologists, and a few minor, specialized occupations). ACR-ASRT presents an estimate of radiographers in all settings based on the number of registered radiographers. AHEM's estimate is for the number of "radiologic technologists" in all settings, but its definition of the occupation seems to include only radiographers. AHA estimates the number of x-ray technicians in hospitals.

Estimating Current Requirements for Radiographers: The general recommendation proposed in Chapter 2 of this report is that a personnel-to-population ratio approach be used to establish current requirements estimates. The review of definitional considerations and of data availability suggests that this is a feasible recommendation for this occupation. Consequently, the following specific recommendations for estimation of current requirements for radiographers are suggested:

Recommendation 1(a): If a decision is made to define radiography as limited to practice by those holding the RT-R issued by ARRT, then it is recommended that a radiographer-to-population ratio be constructed using available data on registered personnel from ARRT. An effort should be made to ensure that the American Registry of Radiologic Technologists data on radiography supply do not encompass other specialties.

Recommendation 1(b): If a decision is made to include within radiography all registered and nonregistered personnel, then it is recommended that no separate estimate of requirements for radiographers be made. Instead an estimate of requirements at the radiologic technology cluster is recommended.

Recommendation 2: Determination of a standard of adequacy for the radiographer-to-population ratio should be made. A national mean or a state median value may be appropriate to the extent data can be obtained. Since use of a national average would incorporate existing shortages into the requirements estimate, it is recommended that determination of the standard of adequacy take into account any existing evidence on the presence of a current shortage (e.g., number of job vacancies, rate or increase in salary levels).

Recommendation 3: Use of the radiographer-to-population ratio standard of adequacy to assess whether subnational geographic regions have sufficient radiographers to meet existing requirements should take into account characteristics of the subnational region in determining whether an excess or shortage of radiographers exists. Specifically, consideration should be given to presence of employment settings in which radiograhers may be employed (e.g., hospitals, physicians' offices) and state licensure requirements.

Estimating Future Requirements for Radiographers: The radiographer-to-population ratio and the standard of adequacy selected to estimate current requirements for radiographers will provide the basis for estimation of future requirements for radiographers.

One alternative approach to estimating future requirements is to assume that the radiographer-to-population ratio standard of adequacy represents the minimum level of future requirements. Therefore, projected increases in the population require that proportional increases in the numerator of the ratio occur. This approach has the advantage of simplicity but fails to take into account factors other than population growth which may be expected to affect requirements for radiographers in the future.

Interviews with individuals knowledgeable of the radiologic technology field focused, to a great extent, on factors which are expected to affect requirements for radiographers in the future. A summary of the more relevant of the findings from these interviews is provided in Table 6. Review of this information has resulted in the development of the following recommendations for determining future requirements for registered radiographers:

> Recommendation 4: The standard of adequacy of the registered radiographer-to-population ratio selected for the estimation of current requirements should be used as the foundation for the development of estimates of future requirements for radiographers. Projections of future population size from the U.S. Bureau of the Census can be used to establish the denominator of the future ratio and the numerator (i.e., required number of radiographers to provide a constant level of services to the future population) can be constructed.
>
> Recommendation 5: Refinement of the estimate of future requirements for radiographers should take into account the factors indicated in Table 6 to the extent possible. While the direction of the effects of such factors on requirements may be clear, the magnitude of the impact have not been determined. Consequently, it is recommended that professional opinions be sought prior to attempting to refine the ratio to permit adjusted future requirements to be calculated.

The importance of many factors, including population change, on future requirements is directly a function of the time interval over which future requirements are to be estimated. Therefore, the input of expert opinion to the future estimates may be crucial. In all cases, it is clear that estimate of future requirements demands that judgmental decisions be made.

Nuclear Medicine Technologists

There are no independent sources of data on nuclear medicine technologists, other than ARRT counts of certified nuclear medicine technologists. The NCHS-SHS Statistics does report estimates for this occupation employed in hospitals. However, there is no way to assess the reliability of either the ARRT estimates or the NCHS-SHS estimates since no comparable data sources exist.

Estimating Current and Future Requirements for Nuclear Medicine Technologists: Review of definitional considerations and the constraints imposed by the limited data available lead to the following recommendation for estimating current and/or future requirements for nuclear medicine technologists:

> It is recommended that no separate estimate of current or future requirements for nuclear medicine technologists be prepared. Instead, total requirements for the professions included in the radiologic technology cluster should be estimated.

Radiation Therapy Technologists

As was described above for nuclear medicine technologists, data sources on subspecialties within this cluster are limited. Only ARRT data on registered radiation therapy technologists and BLS data on radiation therapy technologists in hospitals provide any indication of the number of radiation therapy technologists currently employed. However, no comparable data sources are available to permit validation or assessment of the reliability of these estimates.

Estimating Current and Future Requirements for Radiation Therapy Technologists: Review of definitional considerations and existing data sources leads to the following recommendation, paralleling the recommendation for nuclear medicine technologists:

> It is recommended that no separate estimate of current or future requirements for radiation therapy technologists be prepared. Instead, it is recommended that total requirements for the professions included in the radiologic technology cluster should be estimated.

Combined Professions in the Radiologic Technology Cluster

As can be observed in Table 2, more data are available on the supply and distribution of personnel within the total radiologic technology cluster than for any separate occupation included in the cluster. As a result, it has been recommended that a combined estimate of requirements for personnel in this cluster be prepared, possibly in addition to a separate estimate for registered radiographers. This estimate of total personnel requirements should include both registered and nonregistered personnel, given existing data sources and limitations.

Although there is little consistency in the definition of individual occupations within this cluster, Census, CPS, BLS and NCHS-SHS all present estimates on a clearly defined, cluster level. The first three of these produce data for all employment settings combined, and the estimates exhibit a large degree of consistency. The BLS estimate is within 1,000 persons of the CPS estimate for the same year. The CPS estimates form a fairly consistent growth trend which, when extended back to 1970, coincides with the Census estimate. The distribution of workers among the two major employment settings-- hospitals and physicians' offices--is consistent between BLS and Census; BLS finds 73 percent in hospitals and 20 percent in physicians' offices while Census' estimates are 75 percent and 15 percent, respectively. The NCHS-SHS estimate for hospitals, if compared to the CPS total estimate for the same year, suggests a similar distribution by employment setting (the NCHS-SHS estimate is 71 percent of the CPS total). Both employer-based surveys and household surveys produce reliable estimates of the number of persons employed in the radiologic auxiliary cluster.

In summary, the four data sources discussed above are in agreement on the radiologic technology cluster. Although they do differ in nomenclature, they appear to be including the same types of workers in their definitions. This fact is reflected in the consistency which exists among the estimates both for the total supply of radiologic technologists and for the supply by employment setting. CPS, Census and BLS are all in agreement with regard to total supply. Census and BLS estimates concur for the two largest employment settings--hospitals and physicians' offices. The NCHS-SHS estimate gives further support to the reliability of the other estimates of the supply of radiologic technologists in hospitals.

Estimating Current Requirements for Total Radiologic Technologists: The following specific recommendations for estimation of requirements for total radiologic technologists:

Recommendation 1: If the definition found acceptable for this occupational cluster includes both registered and nonregistered personnel, it is suggested that state-level personnel-to-population ratios be constructed using data from one of the several available sources. Since 1980 census data on this occupational cluster and on population will be available in the near future, this data source may be most appropriate for this estimate.

Recommendation 2: Determination of a standard of adequacy for the radiologic technologist-to-population ratio should be made. A national mean or a state median value may be selected. Information acquired through interviews with persons knowledgeable of the field suggest that a current national shortage of radiologic technologists exists. Consequently, since use of a national average would incorporate existing shortages into the requirements estimate, it is recommended that determination of the standard of adequacy take into account any existing evidence on the presence of a current shortage (e.g., number of job vacancies, rate of increase in salary levels).

Recommendation 3: Use of the radiologic technologist-to-population ratio standard of adequacy to assess whether subnational geographic regions have sufficient radiological technologists to meet existing requirements should take into account characteristics of the subnational region in determining whether an excess or shortage of radiologic technologists exists. Specifically consideration should be given to the presence of employment settings in which radiologic technologists may be employed (e.g., hospitals, nursing homes, physicians' offices) and state licensure requirements.

Estimating Future Requirements for Radiologic Technologists: The radiologic technologist-to-population ratio and the standard of adequacy selected to estimate current requirements for radiologic technologists can provide the basis for estimation of future requirements for radiologic technologists.

One approach to estimating future requirements is to assume that the radiologic technologist-to-population ratio standard of adequacy represents the minimum level of future requirements. Therefore, projected increases in the population require that proportional increases in the numerator of the ratio occur. This approach has the advantage of simplicity but fails to take into account factors other than population growth which may be expected to affect requirements for radiologic technologists in the future.

Review of the information in Table 6 has resulted in the development of the following recommendations for determining future requirements for radiologic technologists:

> Recommendation 4: The standard of adequacy of the radiologic technologist-to-population ratio selected for the estimation of current requirements should be used as the foundation for the development of estimates of future requirements for radiologic technologists. Projections of future population size from the U.S. Bureau of Census can be used to establish the denominator of the future ratio and the numerator (i.e., required number of radiologic technologists to provide a constant level of services to the future population) can then be constructed.
>
> Recommendation 5: Refinement of the estimate of future requirements for radiologic technologists should take into account the factors indicated in Table 6.6 to the extent possible. While the direction of the effects of such factors on requirements may be clear, the magnitude of the impacts have not been determined. Consequently, it is recommended that professional opinions be sought prior to attempting to refine the ratio to permit adjusted future requirements to be calculated.

It is stressed that the results of the interview phase of this project suggest that new technologies and development of new subspecialties are particularly important issues for this occupational cluster. Therefore, adequate attention should be directed to these issues in estimation of future requirements for radiologic technologists.

Chapter 7
Physical Therapy

OVERVIEW OF THE PROFESSION

The function of physical therapy personnel is described in a report by the Bureau of Health Professions (BHPr) as follows:[1]

> Physical therapy personnel provide preventive, diagnostic, and rehabilitative services aimed at the restoration of function and prevention of disability arising from disease, trauma, injury, loss of limb, or lack of use of a body part.

Physical therapy services are provided in cases which involve neurological disorders, nerve or muscular injuries, chest conditions, amputations, fractures, burns, arthritis, and other conditions which require therapeutic and/or rehabilitative care.

Among the services provided by physical therapy personnel are: therapeutic exercises to improve or maintain muscle function; functional activities, such as ambulation and transfer; daily living activities, including the use of assistive devices such as canes, crutches, parallel bars, orthoses, and prostheses; and the application of physical agents to relieve pain or alter physiological status. In addition, patients' families must be included in treatment and rehabilitation, so that they are prepared to continue any necessary processes when the patient returns home.

From its beginnings during World War I, as a service provided by reconstruction aides under the supervision and by the prescription of physicians, physical therapy has grown both in depth and in breadth. During World War II, the demand for physical therapy services grew in great proportion; then, the post-war polio epidemic further fueled the need for physical therapy. In recent years, the role of physical therapy has changed as technical advances and societal needs have required.

For the purposes of this study, two occupations within the field of physical therapy have been considered: physical therapists and physical therapist assistants.

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[1] U.S. DHEW. A Report on Allied Health Personnel. DHEW Publication No. (HRA) 80-28, 1979, p. XI-1.

As an integral member of a multidisciplinary health care group, the physical therapist plays a unique role in helping patients overcome the effects of disease, injury, and developmental abnormalities. Upon the patient's referral from a physician, in most areas, the physical therapist plans and administers a treatment program which assists the patient in reaching maximum performance and functional levels. Moreover, therapists frequently assume responsibility for training and evaluating students on clinical assignments as well as conducting research aimed at improving methods and procedures, and improving the interaction of physical therapy with the other aspects of treatment.

Physical therapist assistants are skilled technical health workers who perform certain patient care activities under the direction and supervision of the physical therapist. The position of physical therapist assistant was developed in the late 1960's by the American Physical Therapy Association to carry out treatment which does not require the complex knowledge required by physical therapists, in order to increase the number of patients to which physical therapy services are available.

As is the case in many of the other allied health professions, the majority of physical therapists and physical therapist assistants are female, with estimates in the range of 70 percent. This situation appears to be changing, though, as more men are attracted to the field, especially in the higher paying private practices. APTA has developed a composite profile of the typical physical therapist, reporting that she is 31 years of age, white, holds a baccalaureate degree, and has worked as a therapist for eight years. In addition, it has been reported that minorities constitute about four percent of the work force.[2]

The development of the physical therapy field has been accompanied by a rapid rate of growth in the number of physical therapists. According to data from the APTA, the number of employed physical therapists has increased from 4,600 in 1950 to over 30,000 in 1978, for an average annual growth rate of 6.9 percent.

Credentialing of physical therapists is fairly consistent from state to state. All states, the District of Columbia, Puerto Rico, and the Virgin Islands, require licensing of physical therapists, either as a Licensed Physical Therapist or as a Registered Physical Therapist (depending on the state). To be eligible for licensure, a candidate must have a degree or certificate from an accredited educational program and pass a state board examination. In addition, the APTA has recommended that, by 1990, a post-baccalaureate degree be required of entry level physical therapists; this recommendation was made in response to the growth in skills and responsibility involved in the functions performed by the physical therapist.

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[2] Ibid., p. XI-4.

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The licensure of physical therapist assistants is subject to considerably more variation than is the case with physical therapists. Only about half of the states require licensure of physical therapist assistants, and the function of the assistant varies considerably from setting to setting.

Traditionally, physical therapy personnel tend to find employment most commonly in hospital settings. According to the BHPr report,[3] hospitals are still the largest employers of physical therapists (with 47 percent of the work force), but there is an evident trend away from the hospital setting. Other employment settings include private practice offices (10 percent), rehabilitation centers (9 percent), nursing homes (8 percent), home health agencies (6 percent), and schools (6 percent). In addition, the passage of the Education for All Handicapped Children Act of 1975 (P.L. 94-142) promises to greatly increase the number of physical therapy personnel employed in public schools.

DEFINITIONAL CONSIDERATIONS

Prior to determining the supply or estimating requirements for physical therapy personnel, it is essential that a definition of each occupation be selected. Fairly consistent credentialing of physical therapists simplifies the task of obtaining data for these professionals, but the task is more difficult for physical therapist assistants.

Physical Therapists

The function of the physical therapist have been described as follows:

> Therapists review and evaluate the physician's referral and the patient's records, and perform evaluative tests and measurements of their own: manual muscle tests, neurodevelopmental tests, and gain functional analyses, among others. There are nearly 60 different examination methods that enable the therapist to establish treatment goals and plan or revise the treatment program. In addition, therapists must maintain a sensitivity to the psychological adjustment of patients made vulnerable by disability or disease.[4]

Moreover, therapists frequently assume responsibility for training and evaluating clinical students, as well as conducting research aimed at improving methods and procedures, and improving the interaction of physical therapy with the other aspects of treatment.

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[3] Ibid., p. XI-1.
[4] Ibid. p. XI-2

Physical therapy is one of only two allied health occupations for which licensure is required in all fifty states, the District of Columbia, Puerto Rico and the Virgin Islands. Requirements for state licensure include graduation from an academic program which has been accredited by the American Medical Association's Council on Allied Health Education in collaboration with the American Physical Therapy Association (APTA), and the successful completion of a licensure examination. Additional educational requirements could affect the growth in the number of graduates from accredited programs.

Physical Therapist Assistants

The physical therapist assistant is trained to provide, under the direction and supervision of a physical therapist, a variety of therapeutic treatment techniques on patients with relatively stable physiological conditions. Specifically, the physical therapist assistant administers noncomplicated, active and passive therapeutic exercises, therapeutic massage, and treatments involving heat, light, sound, water, or electricity. Assistants are also involved in providing instruction and in assisting patients in activities of daily living. The position of physical therapist assistant was developed in the late 1960's by the American Physical Therapy Association to carry out treatment which does not require the complex knowledge required by physical therapists, in order to increase the number of patients to which physical therapy services are available.

Unlike physical therapists, physical therapist assistants need not be licensed in all states. Approximately 25 states require licensure at this time. The occupation of physical therapist assistant is a relatively new one and educational programs for the formal preparation of physical therapist assistants were started in 1967. However, a proportion of this work force receives on-the-job training in some states. Hence, there is no consistency in the basic occupational preparation for this field and no national certification mechanism currently exists for this occupation. As a result of the newness of the occupation and the lack of nationwide educational requirements, or of a nationwide credentialing body, there is no consistent definition of a physical therapist assistant. Prior to determining supply or estimating requirements for physical therapist assistants, it will be necessary to select a definition of the profession to be used for this purpose. Two alternative definitions are suggested:

(1) "Physical therapist assistants" may be defined as those who are employed and who are licensed; or

(2) "Physical therapist assistants" may be defined as those who are employed and perform the therapeutic functions of a physical therapist assistant.

If the first definition is selected then any analytical efforts proposed must be limited to study of those states requiring licensure.

SUPPLY OF PHYSICAL THERAPY PERSONNEL

Data sources providing information on the supply of physical therapy personnel were identified and assessed. Results and recommendations are discussed separately for physical therapists and for physical therapist assistants.

Physical Therapists

Data Sources: There have been six national work force studies over the past seven years that have included estimates of the total number of physical therapists in practice or of the number of physical therapists in selected employment settings such as hospitals or nursing homes. The six studies are:

(1) Occupational Employment Statistics Survey (BLS). Estimates of the number of physical therapists are available for industries at the three-digit Standard Industrial Classification (SIC) level.

(2) Membership Profile Survey (APTA). The American Physical Therapy Association provides membership data on an annual basis. The APTA membership data represent only a portion of total employment in the occupation. It is estimated that approximately two-thirds of all employed physical therapists are members of the professional organization. However, periodic membership surveys, such as the Membership Profile Survey conducted by APTA in 1978, provide information on the distribution of physical therapists by employment setting. Information from the survey has also been used to develop an estimate of the total supply of physical therapists, regardless of membership status.

The APTA study is based on a survey of the 19,568 active members of the American Physical Therapy Association as of April 1, 1978. The response rate was 67 percent. Nonresponse bias is a potential problem, although the magnitude and direction of the potential bias is unknown. In addition, noncoverage of physical therapists who do not belong to APTA provides another potential source of bias. However, APTA attempts to correct for the noncoverage bias in the following fashion. APTA has information on the total number of state licenses reported by licensing boards, and data on the total number of licenses held by the 12,789 respondents to the survey as well as the breakdown of single-state and multiple-state licensees. APTA is able to estimate the total number of active physical therapists by inflating the results of the respondents to the APTA survey to the population of member and nonmember physical therapists.

(3) National Nursing Home Survey (NCHS-NNHS). Estimates are provided on the number of full-time and part-time physical therapists employed in nursing homes in 1977.

(4) Survey of Hospital Staff (NCHS-SHS). The NCHS-SHS was also conducted by the National Center for Health Statistics in an attempt to obtain from hospital administrators a complete enumeration of all full-time and part-time hospital staff, including physical therapists, in all federal and nonfederal hospitals in the United States.

(5) Allied Health Employment Matrix (AHEM). The AHEM estimate of physical therapists was developed on the basis of data from 31 states which accounted for 60.6 percent of the U.S. population in 1976.

(6) Survey of Selected Hospital Manpower (AHA). The AHA study provides data only on physical therapists in AHA registered community hospitals, whereas the NCHS hospital survey and BLS provide estimates for all hospitals, registered and nonregistered, community and noncommunity, alike.

Estimates of the supply of active physical therapists from each of the six studies are presented in Table 7.1.

Data Assessment: A summary of the definition of the population, periodicity, and consistency of the estimates for each of the six data sources is depicted in Table 7.2. Preliminary estimates from BLS and APTA estimates of the total number of physical therapists employed in all settings are extremely close; both estimates represent the sum of full-time and part-time employees. The AHEM estimate is based on full-time equivalents which, if converted to the sum of full-time and part-time persons (two part-time persons were assumed to equal one full-time person), would correspond to a total of 23,793 physical therapists. Since the AHEM data are 1976 estimates (two years earlier than BLS and APTA), the estimates imply an average annual growth rate of 11-12 percent. Such a growth rate is consistent with trends in APTA membership growth over time and trends in the number of graduates of accredited physical therapy programs. Hence, all three estimates of the total supply of physical therapists are in agreement.

The American Physical Therapy Association survey results also permit the estimation of the number of inactive physical therapists in the United States. Only five percent of the respondents to the APTA membership survey were found to be inactive. If employment rates for members and nonmembers are assumed to be equivalent, then there were an estimated 1,500 inactive physical therapists in 1978.

The estimates for various employment settings, although varying more than the total supply estimates, are also roughly consistent. Again, preliminary estimates from BLS and APTA estimates of the number of physical therapists in hospitals settings are almost identical. The 1973

TABLE 7.1. ESTIMATED NUMBER OF ACTIVE PHYSICAL THERAPISTS BY EMPLOYMENT SETTING AND DATA SOURCE[1]

	DATA SOURCE				
EMPLOYMENT SETTING	APTA (1978)[2]	NCHS-NNHS (1977)	NCHS-SHS (1977)	AHEM[3] (1976)	AHA (1973)
Total	29,523			21,200	
Nursing and Personal Care Facilities	2,421	1,100 FT 6,400 PT			
Hospitals	13,907		10,700 FT 2,100 PT		7,978 (7,139.5 FTE)
All Others	13,195				

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[1] BLS estimates do not appear because they were not available for publication at the time that this report was being prepared.

[2] Estimates developed from APTA estimate of total numbers of physical therapists (32,000) and data from APTA Membership Profile Survey on the proportion of employed physical therapists.

[3] Full time equivalent (FTE).

Table 7.2. CONSISTENCY OF ESTIMATES OF ACTIVE PHYSICAL THERAPISTS

Data Source	Coverage	Periodicity	Consistency of Estimate
BLS	Licensed Physical Therapists, Total Supply and by Employment Setting	Triennial, most recently in 1978	Consistent with other estimates for total supply and by employment setting.
APTA	Licensed Physical Therapists, Total Supply and by Employment Setting	1978	Consistent with other estimates for total supply and by employment setting.
NCHS-NNHS	Licensed Physical Therapists in Nursing Homes	1977	Consistent with other estimates for nursing homes.
NCHS-SHS	Licensed Physical Therapists, in Hospitals	1977	Consistent with other estimates for hospitals.
AHEM	Licensed Physical Therapists, Total Supply	1976	Consistent with other estimates for total supply.
AHA	Licensed Physical Therapists in Hospitals	1973	Consistent with other estimates for hospitals.

estimates from AHA indicate approximately a 14-15 percent annual average growth rate in the number of physical therapists in the hospital sector over the 1973-78 time period. The 1977 estimates from NCHS imply a lower annual growth rate of nine percent. This slight difference may be explained, in part, by the downward bias of the AHA estimate as a result of exclusion of hospitals that are not registered with the American Hospital Association. In any event, the estimates of the number of physical therapists employed in hospitals also exhibit a high degree of consistency.

Estimates for other employment settings exhibit somewhat less consistency. The discrepancies can be attributed to at least two sources: (1) differences in the definition and coding of employment settings and full-time/ part-time workers; and (2) sampling variability. For example, the NCHS estimate of the number of physical therapists in nursing homes is over twice as large as the BLS and APTA estimates. However, 6,400 of the 7,500 employees were classified as part-time physical therapists. If the NCHS estimate is converted to full-time equivalents, the estimated number of physical therapists in nursing homes is reduced to 4,300. NCHS also made a concerted effort to identify physical therapy staff employed on a contractual basis in nursing homes. Employees working on a contractual basis may be more likely to hold multiple positions than full-time salaried employees in a nursing home. Thus, the possibility exists that some of the workers may have been counted more than once in the NCHS-NNHS. In addition, sampling variability accounts for some of the differences among the three estimates. However, when confidence intervals are constructed for the estimates and the range of estimates are compared, the results of the different surveys are found to be roughly consistent.

In summary, consistent, reliable estimates are available for the total supply of physical therapists in all settings and in the hospital setting. This is primarily due to the fact that the definition of the physical therapy population is consistent among data sources. There were approximately 29,500-30,000 active physical therapists in practice in the United States in 1978. Of these, roughly 14,000 were employed in the hospital sector. There were an estimated 1,500 physical therapists who were inactive.

Summary and Recommendations: The Occupational Employment Statistics survey provides continuous, reliable national estimates of the total supply of employed physical therapists, and by employment setting. The American Physical Therapy Association provides information on members of the Association. APTA also provides estimates of the total supply of licensed physical therapists on a periodic basis. Consequently, the following recommendation for estimation of the supply of physical therapists is suggested:

It is recommended that both the BLS' Occupational Employment Statistics survey and data provided by APTA be used by the Bureau of Health Professions to estimate the total supply of physical therapists and the supply by employment setting.

Physical Therapist Assistant

Data Sources: Five of the six work force studies of physical therapists also provide data on physical therapist assistants. The American Physical Therapy Association has not conducted a survey of the supply of physical therapist assistants to date; however, APTA did provide information on the number of licensed physical therapist assistants in the United States (for the 22 states that require licensure) as well as information on the number of graduates of accredited physical therapist assistant education programs. The five studies are:

(1) Occupational Employment Statistics Survey (BLS). The Bureau of Labor Statistics survey provides triennial estimates of the total supply of physical therapist assistants and their distribution by employment setting. However, as will be discussed in the following section, the reliability of the BLS estimates cannot be assured. No other source provides continuous estimates of the supply of physical therapist assistants.

(2) National Nursing Home Survey (NCHS-NNHS). The NCHS-NNHS was described in the section on physical therapists. With respect to the definition of the occupation, NCHS-NNHS used a job category entitled, "other physical therapists or assistants" to collect data on individuals providing physical therapy services in nursing homes who do not fall under the category of licensed or registered physical therapists. This survey was conducted in 1977 and is not currently scheduled to be repeated.

(3) Survey of Hospital Staff (NCHS-SHS). The NCHS-SHS attempted to obtain a complete enumeration of all full-time and part-time "physical therapy assistants and aides" employed in federal and nonfederal hospitals throughout the United States. The survey was conducted in 1976-77 and is not scheduled to be repeated at the present time.

(4) Allied Health Employment Matrix (AHEM). The AHEM project provides estimates for 1976 on the number of "certified physical therapist assistants," an occupation for which only eight states provided data. AHEM's national estimates of physical therapist assistants were developed on the basis of data from eight states which account for only 17 percent of the 1976 U.S. population. (Twelve additional states provided estimates of assistants and aides combined.)

It is doubtful that these eight states should be considered representative of the United States population. Only four of the nine Census divisions were represented in the sample. Although the percent of the population residing in metropolitan areas and the median years of school completed by the population of the eight states are approximately the same as the United States average, the mean per capita income of the eight states in 1976 was only $5,986 which was less than the national average of $6,441. Even if representativeness was not an issue, there would be a relatively wide margin of error associated with extrapolation of national estimates from such a small sample of states. For these reasons, the AHEM estimates of the national employment of physical therapist assistants are potentially less accurate than estimates from the other studies. The AHEM project is not currently scheduled to be repeated.

(5) Survey of Selected Hospital Manpower (AHA). Similar to the NCHS-SHS survey, the AHA survey also collected data on "physical therapy assistants and aides." The AHA study was conducted in 1973 and provides data only on the number of assistants and aides employed in AHA registered community hospitals. A more recent study was conducted by the American Hospital Asociation in 1980, the results of which should be available in the near future.

Estimates of the supply of active physical therapist assistants from each of the five studies is presented in Table 7.3.

If the first definition is selected, then any proposed work force estimation efforts must be limited to those states requiring licensure.

Data Assessment: There are no reliable estimates of the total supply of physical therapist assistants or of their distribution by employment setting. (See Table 7.4.) Only two studies--BLS and AHEM--provide estimates of the total employment of physical therapist assistants in all settings. The large discrepancy between the two estimates can be attributed to the inconsistency in occupational definitions. The BLS study does not limit the definition of physical therapist assistants to licensed assistants, or even to graduates of accredited physical therapist assistant educational programs. Hence, the preliminary, unpublished BLS estimate includes individuals who have gone through only brief on-the-job training programs and who lack the formal preparation of their counterparts who have graduated from an accredited educational program. AHEM, on the other hand, sought data on the number of licensed physical therapist assistants. The lack of a well accepted, standard occupational definition means that little confidence can be placed in either estimate.

To put this issue in perspective, the American Physical Therapy Association has reported that approximately 5,000 physical therapist assistants have been graduated from accredited educational programs since

TABLE 7.3. ESTIMATED NUMBER OF ACTIVE PHYSICAL THERAPIST ASSISTANTS BY EMPLOYMENT SETTING AND DATA SOURCE[1]

	DATA SOURCE			
EMPLOYMENT SETTING	NCHS-NNHS (1977)	NCHS-SHS (1977)	AHEM[3] (1976)	AHA (1973)
Total			2,800-2,900	
Nursing and Personal Care Facilities	3,300 FT 1,500 PT			
Hospitals[2]		10,700 FT 2,100 PT		8,146 (7,387.0 FTE)
All Others				

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[1] BLS estimates do not appear because they were not available for publication at the time that this report was being prepared.

[2] NCHS and AHA both report physical therapist assistants and aides rather than physical therapist assistants.

[3] Full time equivalent (FTE).

Table 7.4. CONSISTENCY OF ESTIMATES OF ACTIVE PHYSICAL THERAPIST ASSISTANTS

Data Source	Coverage	Periodicity	Consistency of Estimate
BLS	Licensed and Unlicensed Physical Therapist Assistants, Total Setting	Triennial, most recently in 1978	Inconsistent with other estimates for total supply. Supply and by Employment nursing homes.
APTA	Licensed Physical Therapist Assistants, Total Supply	1978	Inconsistent with other estimates for total supply.
NCHS-SHS	Licensed and Unlicensed Physical Therapist Assistants in Hospitals	1977	Inconsistent with other estimates for hospitals.
NCHS-NNHS	Licensed and Unlicensed Physical Therapist Assistants and Aides in Nursing Homes	1977	Inconsistent with AOTA estimate for nursing homes. Roughtly consistent with BLS estimate for nursing homes.
AHEM	Licensed Physical Therapist Assistants, Total Supply	1976	Inconsistent with other estimates for total supply.
AHA	Licensed and Unlicensed Physical Therapist Assistants and Aides in Hospitals.	1973	Inconsistent with other estimates for hospitals.

TABLE 7.5: MATRIX OF CHARACTERISTICS OF PHYSICAL THERAPY CLUSTER INTERVIEWEES

	GEOGRAPHIC REGION			
CATEGORY	NORTHEAST	NORTH CENTRAL	SOUTH	WEST
Association			XX	
Academic	X		XX	
Employer	X	X		X
Practitioner		X		

1971.[5] The BLS estimate of the number active in the profession exceeds the APTA estimate of the number of graduates by a wide margin. Obviously, a number of individuals are labeled as physical therapist assistants by employers irrespective of the type of training that the individuals have completed.

The lack of a consistent definition is further illustrated by the estimates obtained from the AHA and NCHS-SHS studies of the hospital setting. These two studies sought information on the number of physical therapist assistants and aides. As one would expect, the results are much higher than the estimates obtained from BLS which, in turn, are much higher than the estimates obtained from APTA. As a result of the lack of a consistent definition of the occupation, none of the estimates of the supply of physical therapist assistants can be demonstrated to be reliable.

In summary, due to the facts that the occupation of physical therapist assistant is a relatively new one and that no national certification mechanism currently exists for this occupation, the definition of physical therapist assistants varies widely from source to source. Five different definitions of the occupation were used in the six sources reviewed. They range from "licensed physical therapist assistants" to "physical therapy assistants and aides." As a result, the estimates vary by a wide margin--from a low of 2,800 assistants in all employment settings to a high of 13,100 assistants and aides in the hospital sector alone. Until a standard definition of the occupation is determined, all of the estimates must be considered unreliable. Clearly, a number of individuals are referred to as physical therapist assistants irrespective of the type of training undergone.

Summary and Recommendations: Although the Bureau of Labor Statistics' Occupational Employment Statistics survey provides triennial estimates of the total supply of physical therapist assistants and by employment setting, the reliability of the BLS estimate is not assured. No other source provides continuous estimates of the supply of physical therapist assistants. Review of definitional considerations and existing data sources lead to the following recommendations:

> Recommendation 1: The most important issue prohibiting the collection of reliable estimates of physical therapist assistants is the lack of a consistent definition of the occupation. Further data collection efforts or estimation procedures will be of little use until a standard definition of the occupation is established. This could be accomplished by means of a well constructed role delineation study of the profession. The role delineation study could consist of the

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[5] American Physical Therapy Board of Directors Report to the 1980 House of Delegates, page 145.

administration of an in-depth questionnaire mailed to a randomly selected sample of physical therapist support personnel (e.g., attendants, aides, and assistants) employed in selected settings (e.g., hospitals, nursing homes). The survey would attempt to elicit detailed information on:

- job activities;
- job responsibilities;
- job title;
- educational background;
- credential status; and
- occupational training,

in order to construct a profile of the different categories of employees working within the profession. The survey questionnaire could be developed as a cooperative venture with participants drawn from the relevant professional associations (e.g., APTA), employer associations (e.g., AHA), educators in the field of physical therapy, and federal agencies that deal with health work force issues.

Recommendation 2: If a well defined occupational category can be constructed, the final step would be to include the category in ongoing data collection efforts that currently provide continuous, reliable estimates for other allied health occupations such as the Bureau of Labor Statistics' Occupational Employment Statistics survey or the Census Bureau's Census of Population on Current Population Survey.

REQUIREMENTS FOR PHYSICAL THERAPY PERSONNEL

The derivation of appropriate criteria to indicate requirements for physical therapists was conducted in several phases: (1) interviews with knowledgeable professionals to identify factors affecting current and future supply for physical therapy services; (2) evaluation of the consistency and availability of data on supply of each profession; (3) development of recommendations for estimating current and future requirements for physical therapy professionals; and (4) construction of personnel-to-population ratios for each professions, using the most reliable data available.

Interviews with Physical Therapy Professionals

A full description of the purpose, structure, and methodology used in the interviews was provided in Chapter 2. In this section, a description of the interviewees, a summary of results, and a discussion of implications are presented.

Description of Interviewees: In order to obtain first-hand information on factors determining the level of requirements for physical therapy personnel, telephone interviews were conducted with a small sample of individuals who were selected as being knowledgeable on these issues, as well as having a general familiarity with the state of the profession and trends likely to affect its future. An attempt was made to ensure a representative diversity of views, by contacting individuals affiliated with the relevant professional organizations and occupational training programs, as well as employers, supervisors, and practitioners themselves. In order to represent interarea differences in practice structures, market conditions, and legislative restrictions, an attempt was made to select a geographically diverse interview sample; however, given the restriction on the number of interviews (the sample size was limited to nine for each profession), attainment of this objective was not always possible. In Table 7.5, the distribution of physical therapy interviewees by background and geographic region is depicted. It should be noted that, while each interviewee was selected primarily as representing one of the categories of professional background depicted in Table 7.5, some members of the sample overlapped into more than one category. For instance, all of those interviewed, including those in the non-practitioner categories, have backgrounds as practitioners in physical therapy; in addition, those in the employer/supervisor category also had experience with at least the clinical phase of professional training, since this process is usually conducted in a hospital setting. In such cases, the information provided during the interview sheds light on the issues from multiple perspectives, and thus enhances the effectiveness of the (limited) interviewing effort.

Only one of the persons interviewed was classified as a practitioner in Table 7.5; however, as pointed out above, all nine of the interviewees were trained as practitioners and had practiced as such at some point in their careers. As can be seen from Table 7.5, the representative of this category is located in the North Central region (in Minnesota). She is a physical therapist assistant who is employed both at a hospital and at a small private outpatient facility. She completed her training in 1974.

Three of the interview participants were classified as employers or supervisors of physical therapy personnel. Each of these three individuals is employed as a director of a physical therapy department in a hospital setting; one is located in New Jersey, one in Minnesota, and the third in California. In addition, each of the interviewees in this category had substantial experience in the field of physical therapy (with 20, 35, and 10 years of experience, respectively) and in the supervision of physical therapy personnel (18, 20, and 7 years, respectively). As pointed out above, each was originally trained as a physical therapist; one received her training in Ireland, and the other two in the U.S.

Of the three interviewees in the academic category, one is located in North Carolina, one in New York, and the third in Alabama. Two of these individuals are involved in the training of physical therapist assistants, and the other in a program for physical therapists. Again, each of the interviewees in this category was trained as a physical therapist, and each had at least 17 years in the field.

Also interviewed were two representatives of the American Physical Therapy Association; the Director of the Department of Educational Affairs, and the Associate Executive Director for Communications. These individuals provided an overview of the major issues confronting the profession, especially those concerning training and credentialing, employment conditions, and general trends. In addition to their involvement with the APTA, both of them had prior experience as practitioners, and thus could provide insight into that aspect of the profession, as well.

Results: The nine interviews which were conducted with individuals in the physical therapy field yielded a substantial amount of information on the nature of the field itself, as well as suggesting a set of factors which might be of use in estimating requirements. Although the information collected is qualitative rather than quantitative in nature, the insights which it provides are useful in forming an analytical foundation for future efforts in the estimation of requirements. Topics covered during the interviews included the following:

- the individual's background, experience, and current employment setting;
- a description of professional training programs and training and credentialing issues;
- an assessment of job opportunities in the field, including geographic factors and predominate employment settings;
- the relationship between physical therapy occupations and their role in the provision of overall health care; and
- an observation of current and future trends in physical therapy services, and how they might affect the estimation of personnel requirements.

As indicated by the description of the interviewees presented above, each participant provided a unique outlook on these issues and, despite the diversity of background and experience, a number of general inferences may be drawn from their responses.

One impression that was universal among the interviewees was that there is a severe and worsening shortage of physical therapy personnel. This shortage appears to be prevalent across the country, with few exceptions, and is especially serious and chronic in the rural areas.

In response to these conditions, it appears that salary levels, at least for physical therapists, are usually acceptable and, in areas with especially severe shortages, physical therapy graduates can usually find relatively high starting salaries. Salaries for physical therapist assistants are lower.

The interview participants also indicated that physical therapists are fairly mobile when it comes to employment locations, while physical therapist assistants are less mobile; moreover, there appears to be a strong relationship between the location of the first job and the place in which clinical training was received.

Since job prospects in physical therapy appear so favorable, there is a large pool of applicants to existing physical therapy training programs. However, even though there are from five to ten applicants for every opening, these programs have been limited in the amount by which they can expand the number of graduates. This is due to several factors, including the limited number of faculty (there is presently an eight percent vacancy rate in faculty positions) and shortages of classroom and clinical facilities.

Any growth in the number of graduates must come primarily from new programs, and there does appear to be a trend in this direction; for instance, seven new programs will graduate their first classes during 1981. Moreover, these new programs appear to be springing up primarily in areas which are experiencing personnel shortages. However, despite this increase in the number of graduates, the shortage of physical therapy personnel appears to be growing.

Another major factor in the overall nature of the market for physical therapy personnel is the recommendation by the APTA that, by 1990, the educational requirement for entry level physical therapists be a post-baccalaureate degree. This recommendation, while having no binding authority, has the strength of a moral commitment on the part of educators in the field to cooperate with the professional association; it was proposed as a response to the increasing level of knowledge, skills, and responsibility assumed by physical therapists. Some participants pointed out that, while the increase in training requirements may increase the availability of more productive and responsible personnel, the overall supply of personnel may decrease substantially, as already strained training facilities are further overloaded; as a result, it was pointed out, the cost of services may be expected to rise. In addition, some interviewees expressed doubt that entry level practitioners need the extra training required according to the recommendation.

Factors Affecting Needs-Based Estimates. The medical needs-based approach to estimating health personnel requirements can be thought of as the estimation of an "ideal" number of health professionals--that is, the number that would be needed to serve the population in a given area if all health care conditions which needed treatment were, in fact, to be treated. To that extent, it serves as an upper bound for estimating personnel requirements in that it would be calculated independently of any market constraints on service acquisition.

The nature of physical therapy distinguishes this service from many other consumer purchases in that, to a large extent, the patient frequently does not choose whether to receive these services or how much care he or she will receive; these decisions are only indirectly tied to the consumer's tastes for the service, and are usually made on the advice of the attending physician in response to an existing health condition. Thus, the factors which determine the need (rather than the demand) for physical therapy are of particular importance in estimating personnel requirements.

One factor affecting the need for physical therapy services is the changing makeup of the population. In recent years, there has been an increasing awareness that our population is growing older, and that the growing number of older people may have special requirements for health care. One of these requirements is for increased amounts of physical therapy services; older people are not only more susceptible to conditions requiring physical therapy (arthritis, etc.), but they are more likely to require prolonged care for these conditions.

Technical change also plays a role in determining the need for physical therapy personnel. As the development of diagnostic and treatment equipment allows for the provision of a broader range of services to a larger number of patients, the need for personnel to provide these services will continue to increase, as it has in recent years.

Moreover, as the population becomes more conscious of the importance of physical activity, the need for physical therapy should also rise; unfortunately, the number of knee and leg injuries rises with the number of joggers, the number of back and shoulder injuries with the number of weight lifters, etc. Although the overall health condition of the public may improve, an increase in the need for physical therapy services may result.

Factors Affecting Demand-Based Estimates. The demand-based approach is one which attempts to describe the number of health care professionals desired by a given population, as derived from specified assumptions about market conditions and manpower productivity. These calculations should account for changes in technology, health insurance coverage, the composition of the relevant population, and other economic factors affecting demand and/or productivity.

As pointed out in the discussion above, the demand for physical therapy personnel is growing rapidly. One factor responsible for this growth is an increasing awareness on the part of the public of the usefulness of physical therapy, both in rehabilitation and in preventive care. This factor has resulted in an expansion of the availability of physical therapy departments in hospitals across the country. One interviewee pointed out that more hospitals offer physical therapy services than emergency services.

In addition to an increased public awareness of the importance of physical therapy, there is an increased awareness on the part of physicians of the usefulness of these services. This has been attributed to the increase in physician specialization, which has resulted in a greater willingness to refer patients to care by physical therapists. Since, in most areas, patients must be referred by a physician, this factor is of direct importance in the demand for physical therapy personnel.

Another factor which promises to affect requirements for physical therapy personnel is the Education for All Handicapped Children Act of 1975 (P.L. 94-142), which requires all public schools to have physical therapy services available where there is an identified need for them. This legislation has substantially increased the market for physical therapy personnel, since, prior to its passage, only about six percent of all physical therapists were employed in school systems.

The growth of insurance coverage is another factor which has affected the demand for physical therapy services. The vast majority of these services are paid for by third-party sources (one estimate was 90 percent); thus, the economic barriers to acquisition of the desired care are largely absent. Third-party payments should remain an important factor in the demand for physical therapy as coverage continues to increase. It has also been noted that the amount of paperwork performed by the physical therapist has increased with third-party payments; this may accelerate the increase in demand for personnel by decreasing the time spent by practitioners in the actual provision of services to the patient.

Finally, the expansion of physical therapy into new areas of health care promises to increase the demand for personnel. Specialties such as sports medicine and cardiac rehabilitation are making increased use of physical therapists. As the field broadens in scope, demand should continue to increase.

Other Considerations. In addition to the above-mentioned factors, several other concerns were expressed by the interview participants. One concern was over the high attrition rate among physical therapy personnel. This factor was seen as more prevalent among physical therapist assistants, perhaps due to the relatively low salaries available to these personnel. However, some participants described the attrition rate as declining, due to economic conditions, which restrict the availability of alternate means of employment and necessitate the maintenance of two incomes in many families (this consideration is relevant to physical therapy since the vast majority of practitioners are women).

Another trend which may change the nature of physical therapy services is the growth of non-hospital settings for provision of services. This trend has been accelerated by the enactment ofP.L. 94-142, but is by no means limited to public schools. A number of participants pointed out a trend toward establishment of private physical therapy practices; they cited the increased independence and financial rewards available in these settings as the major factors behind this trend.

The relationship between physical therapy occupations was another topic covered during the interviews. Although this relationship varies according to the setting in which the services are performed, a few general impressions were prevalent:

- o both physical therapists and physical therapist assistants seem to be taking more responsibility in the provision of physical therapy services--for physical therapists, the trend seems to be in the direction of making them the initial contact for the patient, rather than requiring referral by a physician;
- o the interview participants pointed out a lack of professional mobility between physical therapist assistant and physical therapist, although one of the intents of the APTA in creating the former position was to provide for this type of mobility;
- o in addition, a few of the participants commented that the relationship between physical therapy personnel and referring physicians was sometimes strained.

The common impression, however, was that these problems are improving as contact between the professions become more frequent.

Finally, although some trend was noted toward increased entrance into the profession by men (especially in private practice, where salaries are higher) and minorities, there appears to be no strong movement or organized effort in this direction.

Summary: As stated many times throughout this discussion, the issues involved in estimating requirements for allied health personnel are complex and do not lend themselves easily to quantification. However, the interview results also serve to point out that it is possible to gain a deeper understanding of these issues by soliciting the expert opinion of those involved in the various aspects of the profession. A summary of the major issues described in this chapter is depicted in Table 7.6.

The need for further research in the area of physical therapy requirements estimation centers around three major issues:

- o first, there appears to be a need for a comprehensive work force survey (especially in the case of physical therapist assistants), in order to ascertain the number of personnel who are active in each occupation and their distribution by geographic area and setting;

TABLE 7.6. SUMMARY OF MAJOR FINDINGS FROM INTERVIEWS WITH PHYSICAL THERAPY PROFESSIONALS

ISSUE		FINDINGS
Overview	o	There is a severe and worsening shortage of physical therapy personnel, especially in rural areas.
	o	Salary levels, at least for physical therapists, are considered acceptable and responsive to market conditions by members of the profession; salaries for physical therapist assistants are somewhat less desirable to practitioners.
	o	Physical therapists are mobile in response to market conditions; however, there appears to be some connection between the site of clinical training and the location of personnel, especially for physical therapist assistants.
	o	There is a large pool of applicants for physical therapy training programs, but expansion of class sizes is limited by shortages of personnel and facilities; however, the number of new programs is increasing.
	o	The recommendation by the APTA that, by 1990, entry level physical therapists be required to have post-baccalaureate degrees promises to have a substantial effect on the content and structure of training programs, and possibly on the cost and type of services provided.
Need Factors	o	The increasing proportion of older people in the population promises to increase the need for physical therapy services.

TABLE 7.6: (Continued)

ISSUE	FINDINGS
	o Technical change has broadened the field of physical therapy and thus increased the need for physical therapy personnel.
Demand Factors	o Increased awareness by the public of the role of physical therapy in overall health care has increased demand.
	o Awareness on the part of physicians has also increased; since patients must be referred to the physical therapist by a physician, this factor is important in determining demand.
	o P.L. 94-142 has drastically increased the need for physical therapy personnel in public school settings.
	o The majority of physical therapy third party payment reimbursement for services accounts for a vast majority of physical therapy expenditures and have resulted in the rapid growth of demand.
	o The growth of new specialties, such as sports medicine, promises to increase demand still further.
Other Factors	o There is a high attrition rate in the profession, especially among physical therapist assistants; this rate appears to be declining, however, in response to changes in social and economic conditions.
	o The greater degree of financial and professional independence available in private practices is attracting more practitioners to this setting.

TABLE 7.6. (Continued)

ISSUE	FINDINGS
	o There is also a trend toward removal or modification of the physician referral requirement in physical therapy; this factor promises to change the nature and quantity of physical therapy services. o There is little professional mobility between physical therapist assistants and physical therapist positions. o The role of men and minorities in the profession appears to be changing slightly, although in no systematic way.

- second, further study needs to be made of changes in the factors determining the style and setting in which physical therapy services are provided, with special attention to be paid to the effects of P.L. 94-142, the recommendation by the APTA that all entry level physical therapists have post-baccalaureate degrees by 1990, and the trend toward eliminating the physician referral requirement; and

- third, the factors behind the expansion of the demand for physical therapy services should be more closely examined, and their effects described in more detail--the growth of new services such as sports medicine should be of particular interest.

Other issues which should be examined include implications of the growth in physical therapy for education and credentialing, the effects of expansion in the number of training programs, and the distribution of personnel by geographic area.

Finally, it should be noted that the list of factors explicitly considered in this chapter is not a complete list. Other factors also must be considered in developing physical therapy services requirements estimates. A full discussion of the relevant issues is presented below in the occupation-specific sections.

Recommendations for Estimating Requirements for Physical Therapy Personnel Physical Therapists

Table 7.2 summarizes the consistent estimates for the supply of physical therapists. As can be noted, universal licensing requirements guarantee consistent physical therapist estimates. All data sources report only on licensed personnel which accounts for this clarity.

Estimating Current Requirements for Physical Therapists: The general recommendation proposed in Chapter 2 of this report is that a personnel-to-population ratio approach be used to establish current requirements estimates. The review of definitional considerations and of data availability suggest that this is a feasible recommendation for this occupation. Consequently, the following specific recommendations for estimation of current requirements for physical therapists are suggested:

> Recommendation 1: State-level personnel-to-population ratios should be constructed using the 1977 HRA data, BLS, AHEM, or the annual APTA data for licensed physical therapists.
>
> Recommendation 2: Determination of a standard of adequacy for the physical therapist-to-population ratio should be made. A national mean or a state median value may be selected. As use of a national average would incorporate existing shortages into

the requirements estimate, it is recommended that determination of the standard of adequacy take account any existing evidence on the presence of a geographical shortage (e.g., number of job vacancies, rate of increase in salary levels).

Recommendation 3: Use of the physical therapist-to-population ratio standard of adequacy to assess whether identified geographic regions have sufficient numbers of therapists to meet existing requirements should take into account characteristics of these subnational regions in determining whether an excess or shortage of physical therapists exists. Consideration should be given to the presence of employment settings (e.g., hospitals, nursing homes, school systems, faculty positions, and private practice).

Estimating Future Requirements for Physical Therapists: The physical therapist-to-population ratio and the standard of adequacy selected to estimate current requirements for physical therapists will provide the basis for estimation of future requirements.

One alternative approach to estimating future requirements is to assume that the physical therapist-to-population ratio standard of adequacy represents the minimum level of future requirements. Therefore, projected increases in the population require that proportional increases in the numerator of the ratio occur. This approach has the advantage of simplicity but fails to take into account factors other than population growth which may be expected to affect requirements for physical therapists in the future.

Interviews with individuals knowledgeable of the physical therapy field focused, to a great extent, on factors which are expected to affect requirements for the profession in the future. A summary of findings from the physical therapy interviews has been provided in Table 7.6. Review of this information has resulted in the development of the following recommendations for determining future requirements for physical therapists:

Recommendation 4: The standard of adequacy of the physical therapist-to-population ratio selected for the estimation of current requirements for physical therapists should be used as the foundation for the development of estimates of future requirements for physical therapists. Projections of future population size from the U.S. Bureau of the Census can be used to establish the denominator of the future ratio and the numerator (i.e., required number of physical therapists to provide a constant level of services to the future population) can then be constructed.

Recommendation 5: Refinements of the estimate of future requirements for physical therapists should take into account the factors indicated in Table 7.6, to the extent possible. While the direction of the effects of such factors on requirements may be clear, the magnitude of the impact has not been determined. Consequently, it is recommended that professional opinions be sought prior to attempting to refine the ratio to permit adjusted future requirements to be calculated.

The importance of many factors, including population change, on future requirements is directly a function of the time interval over which future requirements are to be estimated. Therefore, the input of expert opinion to estimates of future requirements becomes more critical the further into the future for which projections are to be developed. In all cases, it is clear that estimate of future requirements demands that judgmental decisions be made.

Estimating Current Requirements for Physical Therapist Assistants: The review of definitional considerations and of data availability suggests that construction of a personnel-to-population ratio is problematic for this occupation. Consequently, the following specific recommendations for estimation of current requirements for physical therapist assistants are suggested:

Recommendation 1(a): If a decision is made to define physical therapist assistant as limited to practice by those holding state licensure, then it is recommended that an assistant-to-population ratio be constructed using available data on registered personnel from APTA. The denominator of this personnel-to-population ratio will be limited to the population count for those states which require licensure of physical therapist assistants.

Recommendation 1(b): If a decision is made to include within the physical therapist assistant population all licensed and non-licensed personnel, then it is recommended that use of the triennial BLS data be made. However, these data are not necessarily reliable and, thus, these should be considered only rough estimates.

Recommendation 2: Determination of a standard of adequacy for the physical therapist assistant-to-population ratio should be made. National mean or a state median value may be appropriate, to the extent data can be obtained. Since use of a national average would incorporate existing shortages into the requirements estimate, it is recommended that determination of the standard of adequacy take into account any existing evidence on the presence of a current shortage (e.g., number of job vacancies, rate or increase in salary levels).

Recommendation 3: Use of the physical therapist assistant-to-population ratio standard of adequacy to assess whether subnational geographic regions have sufficient physical therapist assistants to meet existing requirements should take into account characteristics of the subnational region in determining whether an excess or shortage of physical therapist assistants exists. Specifically, consideration should be given to these employment settings in which physical therapist assistants may be employed (e.g., hospitals, nursing homes, rehabilitation centers, home health agencies, schools), state licensure requirements, and the regional supply of physical therapists, relative to population.

It is stressed that estimates of current requirements for physical therapist assistants must be regarded as tentative indications of requirements, given definitional inconsistencies and data considerations. This is a relatively new profession and it may be expected that consensus on a definition of the population may develop as the profession grows and becomes better known and utilized.

Estimating Future Requirements for Physical Therapist Assistants: The physical therapist assistant-to-population ratio and the standard of adequacy selected to estimate current requirements will provide the basis for estimation of future requirements. The following are specific recommendations for determining future requirements for physical therapist assistants:

> Recommendation 4: The standard of adequacy of the physical therapist assistant-to-population ratio selected for the estimation of current requirements should be used as the foundation for the development of future estimates. Projections of future population size from the U.S. Bureau of the Census can be used to establish the denominator of the future ratio and the numerator (i.e., required number of physical therapist assistants to provide a constant level of services to the future population) can be constructed.
>
> Recommendation 5: Refinement of the estimate of future requirements for physical therapist assistants should be developed in coordination with future requirements estimates for physical therapists, since the factors in Table 7.6 will be expected to affect both occupations. In addition, physical therapist assistants are members of a relatively new profession which may be expected to grow as the profession becomes better understood. Consequently, it is recommended that professional opinions be sought prior to attempting to refine the ratio to permit adjusted future requirements to be calculated.

As was mentioned above, the importance of many factors, including population change, on future requirements is directly a function of the time interval over which future requirements are to be estimated. The input of expert opinion to the future estimates may be crucial. This is especially true for an occupation such as physical therapist assistance, which is relatively new and developing a role in the provision of physical therapy services. It should be recognized that estimates of future requirements for physical therapist assistants must be regarded as, at best, only indicative of the future under certain stated assumptions.

Personnel-to-Population Ratios

Review of the findings from this study has resulted in a conclusion that calculation of personnel-to- population ratios, at the national and the state-levels are feasible for the physical therapy work force. These estimates are presented in Tables 7.7 and 7.8 (AHEM, selected states).

No reliable and consistent source of data was identified for the physical therapist assistant population. Therefore, no personnel-to-population ratios have been calculated for this occupation.

TABLE 7.7. NATIONAL PERSONNEL-TO-100,000 POPULATION RATIO, PHYSICAL THERAPISTS, 1978

Occupation	Total Supply 1978	Personnel-to-100,000 Population
Physical Therapists	29,523	13.54

SOURCES: (1) Physical Therapists - Based on data from the 1978 American Physical Therapy Association Census
(2) Population - U.S. Bureau of the Census

TABLE 7.8: PHYSICAL THERAPISTS-TO-100,000 POPULATION, SELECTED STATES, 1976

State	Year of Reported Data	Employment Settings Reported	Form*	Estimated 1976 FTE Employment	Estimated FTE Personnel-To-Population Ratio (per 100,000)
Alabama	1977	All	Total	196.2	5.4
Arizona	1976	All	Total	203.9	9.0
Arkansas	1978	All	Total	97.5	4.6
District of Columbia	1976	General Hospital	FT/PT	332.8	47.4
Florida	1975	All	Total	654.3	7.8
Georgia	1975	Hospitals	FT/PT	377.1	7.6
Illinois	1974	Hospitals	FTE	937.3	8.3
Iowa	1976	All	Total	276.4	9.6
Kansas	1977	All	Total	222.7	9.6
Maine	1976	All	Total	111.6	10.4
Massachusetts	1974	Hospitals	Total	906.6	15.6
Michigan	1976	All	Total	669.1	7.3
Minnesota	1975	Hospitals	FT/PT	523.2	13.2
Mississippi	1977	All	Total	90.4	3.8
Missouri	1976	All	FT/PT	448.0	9.4
Montana	1977	Hospitals	FT/PT	89.0	11.8
Nebraska	1976	All	FT/PT	144.5	9.3
New Hampshire	1973	All	Total	133.5	16.2
New Jersey	1976	General Hospital	FT/PT	1419.2	19.3
North Carolina	1976	All	Total	571.9	10.5
Oklahoma	1973	All	Total	138.1	6.8
Pennsylvania	1976	All	Total	985.2	8.3
Rhode Island	1976	All	Total	97.4	10.5
South Carolina	1977	All	Total	145.3	5.1
South Dakota	1977	All	FTE	47.0	6.9
Tennessee	1976	All	Total	224.1	5.3
Texas	1978	All	Total	1251.0	10.0
Utah	1974	All	FT/PT	117.7	9.6
Virginia	1976	Hospitals	FTE	483.2	9.6
West Virginia	1978	All	Total	96.2	5.3
Wisconsin	1976	All	Total	642.0	13.9

*"FT/PT" indicates employment data were reported as full-time/part-time; "total" indicates that employment was reported as total persons; and "FTE" indicates data were reported as full-time equivalent employment.

SOURCES: (1) Physical Therapists - AHEM
(2) Population - U.S. Bureau of the Census

Chapter 8
Respiratory Therapy

OVERVIEW OF THE PROFESSION

Respiratory therapy services are therapeutic procedures essential in maintaining the life of patients with deficiencies in the cardiopulmonary system. The field of respiratory therapy has developed and expanded since its original designation as inhalation therapy and has undergone considerable change. The expansion of the role of respiratory therapy personnel has been the result of new diagnostic and treatment procedures, the development of cardiopulmonary resuscitation techniques, improvements in the ability to care for patients in acute care facilities, and increased opportunities in maintaining the care of postoperative patients and those with respiratory ailments.[1]

Under medical direction, respiratory therapy personnel must competently administer various types of gases and aerosolized drugs with knowledge of airway mechanics and techniques that can analyze blood gases. They must combine these skills with knowledge of specialized equipment. The respiratory therapist's functions may include the following: humidity/aerosol therapy, medical gas administration, intermittent positive pressure breathing, continuous ventilation, airway management, administration of medical gases, cardiorespiratory rehabilitation and drug administration, and infection control, endotracheal intubation, and arterial blood gas sampling and analysis.*

Respiratory therapists working under a physician's supervision, provide prescribed respiratory therapy care and life support to patients with abnormalities of the cardiopulmonary system. They provide a variety of services such as setting up, operating, and monitoring ventilators, therapeutic gas administration apparatus, aerosol generators, ultrasonic aerosol treatments, stress tests, environmental control systems, and arterial blood gas analysis. Respiratory therapists assist patients with breathing exercises, conduct treatments prescribed by physicians, perform bronchial hygiene, and bronchopulmonary drainage.[2]

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[1] A Report on Allied Health Personnel. DHEW Publication No. (HRA) 80-28, November 1979, p. XIII-I.

*Depending upon local practice standards, this list of functions can be considerably greater.

The majority of respiratory therapists work in hospital settings, primarily in such departments as respiratory therapy, anesthesiology, or pulmonary medicine services. They also provide home care services and work with respiratory (inhalation) therapy equipment companies that sell and service the equipment. Other settings include diagnostic laboratories, research labs, educational institutions, home health care agencies, private clinics or physicians' offices, and nursing homes.

Respiratory therapy technicians work under the supervision of a respiratory therapist or a physician. Many of their functions are identical to those of the therapist. Responsibilities of the technician vary with the policy of the employing institution. On the whole, technicians exercise less independent judgment than respiratory therapists. Their work environment is the same as the respiratory therapist as they work primarily in the hospital setting. Respiratory therapy technicians provide treatment and maintain patient records. They also tend to be more widely used in the acute care environment than the critical care environment.

Recognition of respiratory therapy as a separate professional field is a recent development. Originally, its functions were limited to such tasks as delivering equipment and setting up oxygen tents. Expansion of the role of these professionals has occurred rapidly over the past decade.

Educational standards and essentials for accredited respiratory therapy educational programs are developed and endorsed by the American Association for Respiratory Therapy, the American Association of Chest Physicians, the American Society of Anesthesiologists, and the American Thoracic Society. These programs are accredited by the American Medical Association's Committee on Allied Health Education and Accreditation.

The current requirements for qualification as a RRT involve a 24-month program which includes didactic work, clinical experience, plus the general requirements for an A.A. degree. Some institutions are now offering baccalaureate programs in respiratory therapy. Programs for respiratory therapy technicians are open to high school graduates, are at least one year in length, and combine academic work with clinical training. Hospitals, vocational-technical schools, junior and community colleges, and senior colleges all may offer programs for technicians.

Credentialing of respiratory therapy personnel is a voluntary process that is conducted through the National Board of Respiratory Therapy (NBRT) which is the credentialing body for the respiratory therapy profession. The NBRT administers examinations for both the registeredrespiratory therapist (RRT) and the certified respiratory therapy technician (CRTT). Although the NBRT sets the criteria for qualifying for the examination, credentialing is a voluntary process. Only in the State of Arkansas is licensure required to practice respiratory therapy.

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[2] Ibid.

Information on the characteristics of respiratory therapy professionals was presented in A Report on Allied Health Personnel.[3]

- o Approximately one-half of the current work force had neither formal training nor professional credentials through 1977.
- o In this time period, approximately 8 percent of the work force were Registered Respiratory Therapists; 32 percent were Certified Respiratory Therapy Technicians; 4 percent held both RRT and CRTT credentials; and nearly 56 percent had no professional credentials.
- o A substantial segment of the work force is engaged in providing clinical services. Approximately 50 percent are in basic practice and another 20 percent are in advanced practice.

DEFINITIONAL CONSIDERATIONS

Prior to determining the supply or estimating requirements for services provided by respiratory therapy professionals, it is essential that a consistent definition of each occupation be selected. However, for this occupational cluster, definitional problems exist.

Respiratory Therapists

The basic reasons for the lack of clear definition of the occupation include: (1) credentialling of respiratory therapy personnel is a relatively recent phenomenon; (2) licensure is required for respiratory therapists in only one State; and (3) role delineation is unclear between respiratory therapists and respiratory therapists technicians.

Consequently, definitional issues have a substantial impact on the potential for accurate estimation of supply and requirements for respiratory therapy personnel. Prior to estimating supply and requirements for respiratory therapists, it will be necessary to select a definition of the population. Two alternative definitions are suggested:

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[3] Ibid., p. XIII-3.

(1) "Respiratory therapists" may be defined as those who are employed and who have completed all AART requirements for the RRT; or

(2) "Respiratory therapists" may be defined as the total supply of registered and nonregistered persons employed as respiratory therapists.

For this occupation, the difference between the two definitions may lead to substantially different estimates of the supply of respiratory therapists.

Respiratory Therapy Technicians

The educational requirements and functions performed by the respiratory therapy technician are not well defined or understood. As a result, there are substantial numbers of persons employed as repiratory therapy technicians with widely differing educational and experiential backgrounds. Although AART has a specified set of standards for the individual wanting to become a Certified Respiratory Therapy Technician (CRTT), it is uncertain what proportion of the total work force is certified.

Given the lack of agreement on the educational requirements and functions of the respiratory technician, it is obvious that a clear definition of this profession is a critically necessary first step prior to determining the supply or estimation of requirements for this category of personnel. Two alternative definitions could be considered:

(1) "Respiratory therapy technicians" may be defined as those who are employed and who are Certified Respiratory Therapy Technicians by AART standards; or,

(2) "Respiratory therapy technicians" may be defined as those who are employed and perform respiratory therapy technician functions.

If the latter definition is chosen, individuals with knowledge of the profession should be consulted to refine the definition to exclude functions more appropriately assigned to respiratory therapists.

SUPPLY OF RESPIRATORY THERAPY PERSONNEL

Data sources providing information on the supply of respiratory therapy professionals were identified and assessed. Results and recommendations are discussed separately for respiratory therapists and respiratory therapy technicians.

Data Sources: Four studies have produced estimates of the number of active respiratory therapists or RRTs. These sources are discussed below.

(1) Occupational Employment Statistics Survey (BLS). This employer-based survey, conducted by the Bureau of Labor Statistics, collects data by employment setting on the number of respiratory therapists, who BLS defines as persons who "set up and operate various types of equipment such as iron lungs, oxygen tents, resuscitators, and incubators to administer oxygen and other gases to patients." BLS estimates include both registered and nonregistered personnel, with no distinction made between the two.

(2) Survey of Hospital Staff (NCHS-SHS). This National Center for Health Statistics survey produced an estimate of the number of respiratory therapists, regardless of credential status, employed in hospitals. The definition used is similar to that used by BLS. At the present time, there are no plans to repeat this survey or update its estimates.

(3) Respiratory Therapy Uniform Manpower Survey (AART). The American Association for Respiratory Therapy study is based on 18,974 responses to a 1977 sample survey of hospital personnel. This survey collected information on persons performing any one of a range of respiratory therapy duties. This information includes credential status of surveyed persons. From this data, AART produced an estimate of the number of RRTs in the active work force.

(4) Allied Health Employment Matrix (AHEM). Separate estimates were produced for RRTs and for all respiratory therapists. The AHEM study used data supplied by 18 States. Of these, five had data on registered personnel only, two had data for registered and for total, and the remaining 11 had data for only the total number of respiratory therapists. In the sample of all States which had data for total respiratory therapists (13 States) only six of the nine Census regions were represented. States providing estimates of employment only for the hospital sector were assumed to include all employment settings, since the majority of respiratory therapists work in hospitals. This was the case for nine States.

The estimates produced by these sources are presented in Table 8.1.

Data Assessment: On first inspection, there appears to be a fair amount of agreement among the estimates of the supply of respiratory therapists. The AART estimate of RRTs in 1977 and the preliminary, unpublished BLS estimate of respiratory therapists in 1978 both lie toward the lower ends of the respective AHEM 1976 ranges. The AHEM ranges, then, imply a somewhat higher supply (in an earlier year) than that estimated by the other sources. Furthermore, AHEM ranges are expressed in full-time equivalent (FTE) terms. If these estimates were converted to represent the total number of employees, they would become even larger relative to the BLS and AART estimates. A closer inspection

TABLE 8.1. Estimated Supply of Active Respiratory Therapists by Employment Setting and Data Source[1]

Employment Setting	Data Source NCHS-SHS (1977)	AART (1977)	AHEM[3] (1976)
Total		6,195 RRT[2]	15,000-18,000 5,056-6,044 RRT
Hospitals	11,600 FT		
All Others	1,400 PT		

[1] BLS estimates do not appear because they were not available for publication at the time that this report was being prepared.

[2] Includes 2,053 who hold certification as both RRTs and CRTTs. These are not included in the AART estimate of CRTTS in Table 3.

[3] Full time equivalent (FTE).

of the way in which the AHEM estimates were derived suggests that they are even less consistent with the other estimates. In deriving a national estimate from state data on respiratory therapists, AHEM assumed full employment setting coverage for States which provided data on hospitals only. The BLS estimate suggests that only 78 percent of all respiratory therapists are employed in hospitals. If this proportion is correct, then the AHEM estimate would represent hospital employment more closely than total, and would have to be adjusted upward to account for other employment settings. If this were done, the AHEM estimate would be inconsistently high compared to other estimates. There is rough consistency between the ratio of registered to total respiratory therapists as calculated from the AHEM estimates and that calculated using the AART estimate of registered therapists and the BLS total estimate. Therefore, one might conclude that this ratio is roughly accurate and that somewhat less than 50 percent of all respiratory therapists are RRTs.

BLS is the only source which presents estimates for a variety of employment settings. The preliminary, unpublished BLS hospital estimate for 1978 is consistent with the NCHS-SHS estimate for 1977, but this comparison is trivial since the former was based on the latter. There is no way to assess the reliability of the BLS employment setting estimates.

The evaluation of the estimates of the supply of respiratory therapists is summarized in Table 8.2.

Summary and Recommendations: The scarcity of estimates of the supply of respiratory therapists makes the evaluation of existing data more difficult. Counts of registered workers are available from the National Board of Respiratory Therapy, but these give no information on the number of employed RRTs. In addition, the collection of reliable estimates is inhibited by inconsistency in the definitions of the population. The definitional problem arises out of the fact that there is no clear relationship between credentialed status and work duties performed in the respiratory therapy field. The following recommendations address the problems of scarcity of data and definitional inconsistency.

> Recommendation 1: It is recommended that all of the studies on respiratory therapists be reevaluated when the results of the 1980 Census of Population are made available. As a result of changes in the Standard Occupational Classification codes, the 1980 census will provide estimates of the total supply of respiratory therapists, and by employment setting. The Census results can then be contrasted with previous studies to assess the consistency of the estimates for the total supply and by employment setting.
>
> Recommendation 2: In order to establish a standard definition for the target population of respiratory therapists, a role delineation study is suggested.

Table 8,2. Consistency of Estimates of Active Respiratory Therapists

Data Source	Coverage	Periodicity	Consistency of Estimate
BLS	Registered and Nonregistered Respiratory Therapists, Total Supply and by Employment Setting	Triennial, most recently in 1978	Inconsistent with AHEM for total supply.
AART	Registered Respiratory Therapists, Total Supply	1977	Inconsistent with AHEM for total registered therapists.
NCHS-SHS	Registered and Nonregistered Respiratory Therapists in Hospitals	1977	Consistency unassessable.
AHEM	Registered and Nonregistered Respiratory Respiratory Therapists, Total Supply	1976	Inconsistent with BLS for total. Inconsistent with AART for total registered.

The role delineation study could consist of the administration of an in-depth questionnaire mailed to a randomly selected sample of respiratory therapists and respiratory therapy support personnel (e.g., technicians, aides, and assistants) employed in selected settings (e.g., hospitals, nursing homes). The survey would attempt to elicit detailed information on:

- job activities;
- job responsibilities;
- job title;
- educational background;
- credential status; and
- occupational training,

in order to construct a profile of the different categories of employees working within the profession.

The survey questionnaire could be developed as a cooperative venture with participants drawn from the National Board of Respiratory Therapy, the American Hospital Association, educators in the field of respiratory therapy, and federal agencies involved in allied health work force issues. The results of such a study should be used to establish criteria for defining the population for which information is sought (i.e., respiratory therapists).

Respiratory Therapy Technicians

Data Sources: Of the four sources of estimates for respiratory therapists, only BLS does not present an estimate of the supply of respiratory therapy technicians. The data sources for respiratory therapy technicians are as follows:

(1) Survey of Hospital Staff (NCHS-SHS). In addition to collecting data on respiratory therapists, the National Center for Health Statistics' 1977 survey collected data on the number of respiratory therapy technicians employed in hospitals.

(2) Uniform Manpower Survey (AART). The 1977 survey produced an estimate of the number of persons performing respiratory therapy roles who hold the credential CRTT.

(3) Allied Health Employment Matrix (AHEM). As it did for respiratory therapists, the Bureau of Health Professions' AHEM study produced estimates for both CRTTs and total respiratory therapy technicians. The AHEM study used two samples to estimate numbers of respiratory therapy technicians. One group consisted of four States which reported data for certified respiratory therapy technicians, and

the other group was composed of nine States which supplied figures for all certified and noncertified respiratory therapy technicians. One State, New Jersey, was included in both of the groups.

Unlike the approach used for estimation of respiratory therapists, AHEM did not assume full employment setting coverage for states which reported only hospital employment of respiratory therapy technicians. Instead, the employment setting distribution for New Jersey was used to extrapolate full employment setting numbers for states which provided information on hospitals only. The reliability of such a procedure depends upon the representativeness of New Jersey's distribution of employment by setting.

The estimates produced by these sources are presented in Table 8.3.

Data Assessment: The evaluation of the estimates of the supply of respiratory therapy technicians is summarized in Table 8.4. Scarcity of data is the largest problem confronted in dealing with the estimates of the supply of respiratory therapy technicians. The only comparable estimates are the AART 1977 estimate of 16,707 CRTTs and the AHEM 1976 estimate of 9,500 CRTTs. These estimates are clearly inconsistent, and there is no figure to compare with either the AHEM estimate of between 21,000 and 25,000 total respiratory therapy technicians or the NCHS-SHS estimate of 23,800 respiratory therapy technicians in hospitals in 1977. None of the sources provides estimates of the active work force on a continuing basis.

Summary and Recommendations: Among the most important issues prohibiting the collection of reliable estimates of respiratory therapy technicians is the lack of consistent definition of the occupation. Further data collection efforts or estimation procedures will be of little use until a standard definition of the occupation is established. Therefore, the first recommendation pertains to arriving at this definition.

> Recommendation 1: In order to establish a standard definition for the target population of respiratory therapy technicians, a role delineation study is suggested. The role delineation study could consist of the administration of an in-depth questionnaire mailed to a randomly selected sample of respiratory therapists and respiratory therapy support personnel (e.g., technicians, aides, and assistants) employed in selected settings (e.g., hospitals, nursing homes). The survey would attempt to elicit detailed information on:
>
> - job activities;
> - job responsibilities;
> - job title;
> - educational background;
> - credential status; and
> - occupational training,

Table 8.3. Estimated Supply of Active Respiratory Therapy Technicians by Employment Setting and Data Source

	Data Source		
Employment Setting	NCHS-SHS (1977)	AART (1977)	AHEM[1] (1976)
Total		16,707 CRTT	21,000-25,000 9,500 CRTT
Hospitals	20,300 FT 3,500 PT		

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[1] Full time equivalent (FTE).

Table 8.4. Consistency of Estimates of Active Respiratory Therapy Technicians

Data Source	Coverage	Periodicity	Consistency of Estimate
NCHS-SHS	Certified and Non-certified Respiratory Therapy Technicians in Hospitals	1977	Not assessable due to unique coverage.
AART	Certified Respiratory Therapy Technicians, Total Supply	1977	Inconsistent with AHEM for total supply of registered respiratory therapy technicians.
AHEM	Certified and Non-certified Respiratory Therapy Technicians, Total Supply	1976	Inconsistent with AART for total supply of registered respiratory therapy technicians.

in order to construct a profile of the different categories of employees working within the profession.

The survey questionnaire could be developed as a cooperative venture with participants drawn from the National Board of Respiratory Therapy, the American Hospital Association, educators in the field of respiratory therapy, and federal agencies involved in allied health work force issues. The results of such a study should be used to establish criteria for defining the population for which information is sought (i.e., respiratory therapy technicians).

Recommendation 2: If a well defined occupational category can be constructed, the final step would be to include the category in ongoing data collection efforts that currently provide continuous, reliable estimates for other allied health occupations such as the Bureau of Labor Statistics' Occupational Employment Statistics survey or the Census Bureau's Census of Population or Current Population Survey.

Overall, it should be recognized that estimating the supply of respiratory therapy technicians will be an imprecise exercise at best. The occupation is relatively new and not well defined except for CRTT requirements. In addition, current data availability and quality are limited. Thus, these estimates, if developed, should be relied upon only with great caution.

It should also be recognized that definitional problems for this cluster are very severe. Neither credentialing nor work duties can be used to develop clear occupational definitions, since the same wide range of duties is performed by Registered Respiratory Therapists, by Certified Respiratory Therapy Technicians, and by workers with no credentials at all. Therefore, it must be stressed that implementation of the recommendations in this chapter, using available data, may produce relatively acceptable estimates of current and/or future supply of personnel only if each profession is defined as consisting only of credentialed personnel. However, since it appears that substantial numbers of noncredentialed persons are practicing in this field, estimates of the supply of credentialed personnel only will not produce accurate information on the actual work force of respiratory therapy services. Thus, these estimates would have to be used with caution.

REQUIREMENTS FOR RESPIRATORY THERAPY PERSONNEL

The derivation of appropriate criteria to indicate requirements for respiratory therapy professionals was conducted in several parts: (1) interviews with knowledgable professionals to identify factors associated with current and future requirements for respiratory therapy services; (2) evaluation of the consistency and availability of data on supply of each profession; (3) development of recommendations for estimating current and future requirements for respiratory therapy professionals; and (4) construction of personnel-to-population ratios for each profession, using the most reliable data available.

Interviews with Respiratory Therapy Professionals

A full description of the purpose, structure, and methodology used for the interviews is contained in Chapter 2. In this section, a description of the selected interviewees, a summary of results, and a discussion of implications are presented.

Description of Interviewees: In order to gather current and relevant information on respiratory therapists and respiratory therapy technicians, and in order to achieve appropriate diversity, telephone interviews were conducted with a small sample of individuals who are knowledgeable on issues and familiar with practice and current trends.

Two individuals are representatives of the professional association, the American Association of Respiratory Therapists (AART). Both of these persons are RRTs who have practiced in the field as practitioners and supervisors, and continue to practice while fulfilling responsibilities for the AART.

In addition to association representatives, two respiratory therapy professionals were selected who are knowledgeable with respect to educational issues in the profession. One of these interviewees is an associate professor of Respiratory Therapy and the other is head of the Department of Respiratory Therapy in a large state university.

Two supervisors and one employer were chosen to participate in the interviews. One of these individuals is director of a firm that provides personnel, equipment, and managerial responsibility for respiratory therapy services. This respondent who has expertise in clinical pharmacy, in pharmacology, and in training programs is also in charge of work force planning, management development, and serves as a liaison with relevant professional associations. The other two interview participants supervise respiratory therapy departments in hospital settings. One of the supervisors is also a physician and is board-certified in anesthesiology.

Two respiratory therapy practitioners were chosen, one from a small community hospital and who is a recent practitioner; the other therapist has been in practice for eight years and is working for a large community hospital associated with a private university.

An effort was made to select a geographically-diversified sample of interview participants. Table 8.5 summarizes the geographical and categorical distribution of the nine interview participants.

Results: A shortage of respiratory therapy personnel was expressed as existing by several interviewees. They stated that the shortage exists on a national level and that it has been evident for several years.

There was general agreement among most interview participants that educational requirements for personnel have changed in recent years as the nationwide credentialing examinations have become more rigorous and the training programs have moved from hospital-based settings to colleges and universities.

Concern was expressed by several of the interview participants regarding the adequacy of respiratory therapy programs and current educational requirements. One participant foresees a shift to baccalaureate programs because of the need for additional training to teach materials and the basic science requirements. Another interviewee suggested the need for training beyond the associate degree level especially for such areas as management. On the other hand, one interviewee expressed the belief that there may be no need for training in respiratory therapy beyond the associate degree level. Furthermore, although the continuing education programs are considered to be important, this person does not feel that these programs should be mandated.

Little consensus on the issue of credentialing was reached among the professionals interviewed. Some of the participants believed that mandatory credentialing would not restrict the supply of respiratory therapy personnel and one thought it would be negligible. The proponents for mandating licensure argued the following:

- Mandatory licensure would increase the quality of available services as it functions as a quality control measure;
- Licensure outlines a minimum standard for professional training and education;
- It functions as a means of restricting the entry of unqualified personnel into the field;
- Credentialing does not have the same legal impact as licensure; and
- Noncredentialed or non-licensed personnel may compromise the well-being of a patient as they are trained to do specific tasks without the benefit of understanding the nature and risks of the task.

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- Licensure outlines a minimum standard for professional training and education;
- It functions as a means of restricting the entry of unqualified personnel into the field;
- Credentialing does not have the same legal impact as licensure; and
- Noncredentialed or non-licensed personnel may compromise the well-being of a patient as they are trained to do specific tasks without the benefit of understanding the nature and risks of the task.

Table 8.5. Matrix of Characteristics of Respiratory Therapy Interviewees

	GEOGRAPHIC REGION			
CATEGORY	NORTHEAST	NORTH CENTRAL	SOUTH	WEST
Association	X	X		
Academic	X		X	
Employer/Supervisor			XXX	
Practitioner		XX		

The decline of noncredentialed personnel as a proportion of the total labor force is foreseen by some of the interview participants for the following reasons:

(1) Clinical practice is more complicated than it was 10 years ago due to an increase in sophistication of pulmonary medicine requirements; and

(2) Third party payment (i.e., Blue Cross and Blue Shield and Medicare) in non-hospital settings require more accountability of personnel resulting in demand for better trained personnel.

It should be pointed out that some of the interview participants qualified this opinion, stating that general economic conditions also play a role in the level of utilization of noncredentialed personnel. Contrary to the opinions expressed by some interview participants that the proportion of the total noncredentialed labor force may be on the decline, one participant pointed out that an increase in noncredentialed personnel is likely to occur. This participant noted that third-party payers already reimburse in hospital settings and as a result, the demand is already there.

Factors Affecting Needs-Based Estimates. The interviews yielded little information on trends affecting needs-based factors. This allied health profession involves only indirect patient choice in the purchase of such services. One interviewee pointed out that the main factor influencing the need for respiratory therapy personnel is the number of physicians with patients needing services.

Advances in technology and new discoveries in pulmonary physiology were indicated as a major factor affecting the need for respiratory therapy personnel. These changing technologies have increased the need for respiratory therapy as more cardiopulmonary conditions are diagnosed at earlier stages and are treated more frequently, and for longer time intervals. These more complex technologies also have led to higher educational requirements, according to the professionals interviewed, as on-the-job training is inadequate to handle such needs.

Another factor which has had an impact on the need for services of respiratory therapists and respiratory therapy technicians is the changing structural composition of the population. Since older persons have more chronic conditions requiring treatment, as the number of aged persons increases, the need for allied health personnel such as respiratory therapy professionals also increases.

Factors Affecting Demand-Based Estimates. Needs criteria is one approach to identifying requirements for respiratory therapy personnel. An alternative method, a demand-based approach, utilizes economic factors such as effective demand (i.e., wants and ability to pay) for services.

Several interview participants contend that there is a growing demand for respiratory therapy personnel. The number of prospective employers seeking to hire graduates of respiratory therapy programs has increased in recent years and this trend is expected to continue. This increase may be due to respiratory therapy education expanding into new functional areas. That is, the educational programs are beginning to provide training in areas such as pulmonary function, rehabilitation, and hemodynamic monitoring. This expansion has resulted in the creation of greater demand for personnel to perform a wider range of services.

The expansion of demand for respiratory services has been predominately in settings where services are reimbursed. Coverage under Medicare and Medicaid creates a situation in which persons with a need for respiratory therapy are financially able to obtain such services. Related to the effect of reimbursement as a demand-increasing factor, several participants said that the emphasis on health care cost containment and general economic conditions in the country may result in decreased demand for respiratory therapy services. It was also pointed out that development of additional criteria in order to receive reimbursement may affect demand for services as it results in the need for more accountability.

Another factor which has influenced the growth of demand for respiratory services is increased awareness by physicians and by the population about the importance of pulmonary disease and improved methods of diagnosis. The American Association of Respiratory Therapists initiated a public awareness campaign in 1980 to increase awareness of the profession and to attract more people into this field.

Other Considerations. Interviewees indicated that although the majority of respiratory therapy personnel are male, more women have been entering the field in recent years. Many interviewees noted that the low salary levels received by therapists prohibits men from entering or staying in the profession. The retention rate of personnel is considered low and although exact figures are not present, the interviewees expressed the following opinions:

- The average length of stay of respiratory personnel in one position is approximately two years.
- An interviewee maintains that the turnover rate is high due to women marrying and leaving the hospital setting.
- A few participants considered this profession to be a high stress job, thus causing high turnover rates.

Another concern to the profession, according to one of the interview participants, is the maldistribution of respiratory services nationally. Areas of the country in the South and Southeast tend to have greater difficulty attracting personnel.

It was also pointed out that shifts in the employment setting of respiratory therapists is likely to occur. According to one interviewee, respiratory therapy services will become less hospital-based and will be providing diagnostic and therapeutic services through home health agencies, in nursing homes, and in physicians' offices in greater numbers in the future. It was also noted that it would be more cost-effective if respiratory therapy services were conducted outside the hospital setting.

The maintenance of high professional standards, especially as the increase in technologies continues, has created considerable concern for many of the participants. Several mentioned a revision of educational essentials to reflect the increased knowledge base. Others noted the need for upgrading educational requirements to a baccalaureate degree. However, this was not a universal consensus.

Summary: Major factors relevant for requirement estimates for respiratory therapy personnel are summarized in Table 8.6. Overall, the professionals interviewed were optimistic about the future demand for personnel to provide respiratory services.

Several factors were expected to be influential and/or to be influenced by the development of the field in the future:

- The expansion of clinical duties due to increased awareness by medical personnel of the utility of respiratory therapy.
- Increase in educational requirements.

Although the interviewees acknowledged that requirements exist and are increasing, there was pessimism regarding the ability to produce an adequate supply of properly trained respiratory therapy personnel. The issue of appropriateness of training and the definition of the training and functions which characterize the respiratory therapy workforce is associated with the development of estimates of current and future requirements for personnel in this field.

It should be pointed out that the factors presented in table 6 do not represent a comprehensive list of requirements indicators. Other factors should be considered in addition to those discussed here. These may include such indicators as population, income, number of health facilities, etc. These and other variables are discussed and described in the following occupation-specific sections of this report.

Recommendations for Estimating Requirements for Respiratory Therapy Personnel

Estimating Current Requirements for Respiratory Therapists: The general recommendation proposed in Chapter 2 of this report is that a personnel-to-population ratio approach be used to establish current requirement estimates. The review of definitional considerations and of data availability suggests that a personnel-to-population ratio may be a feasible recommendation for this occupation. Consequently, the following specific recommendations for estimation of current requirements for respiratory therapists are suggested:

> Recommendation 1: National and/or state-level personnel-to-population ratios using data from AART or from BLS, after the definition of respiratory therapist to be used has been selected. Although no comparable data were available, an assumption has been made that AART has the most reliable data on RRTs and that BLS has the most reliable (though unassessed) data on the total supply of registered and nonregistered respiratory therapists.
>
> Recommendation 2: Determination of a standard of adequacy for the respiratory therapist-to-population ratio should be made. A national mean or a state median value may be selected depending upon the definitional choice. Since use of a national average would incorporate existing shortages into the requirements estimate, it is recommended that determination of the standard of adequacy take into account any existing evidence on the presence of a current shortage (e.g., number of job vacancies, rate of increase in salary levels).
>
> Recommendation 3: Use of the respiratory therapist-to-population ratio standard of adequacy to assess whether subnational geographic regions have sufficient respiratory therapists to meet existing requirements should take into account characteristics of the subnational region in determining whether an excess or shortage of respiratory therapists exists. Specifically, consideration should be given to the presence of employment settings in which respiratory therapists may be employed (e.g., hospitals and nursing homes). In addition, the supply of respiratory therapy technicians should be considered in examining the adequacy of the existing respiratory therapist supply to meet requirements. These two professions provide overlapping functions to patients and, consequently, estimates of current or future requirements should explicitly recognize this substitutability.

Estimating Future Requirements for Respiratory Therapists: The respiratory therapist-to-population ratio and the standard of adequacy selected to estimate current requirements for respiratory therapists will provide the basis for estimation of future requirements for respiratory therapists.

One alternative approach to estimating future requirements is to assume that the respiratory therapist-to-population ratio standard of adequacy represents the minimum level of future requirements. Therefore, projected increases in the population require that proportional increases in the numerator of the ratio occur. This approach has the advantage of simplicity but fails to take into account factors other than population growth which may be expected to affect requirements for respiratory therapists in the future.

Interviews with individuals knowledgeable of the respiratory therapy field focused, to a great extent, on factors which are expected to affect requirements for respiratory therapists in the future. A summary of the more relevant of the findings from these interviews has been provided in table 6. Review of this information has resulted in the development of the following recommendations for determining future requirements for respiratory therapists:

> Recommendation 4: The standard of adequacy of the respiratory therapist-to-population ratio selected for the estimation of current requirements for respiratory therapists should be used as the foundation for the development of estimates of future requirements for respiratory therapists. Projections of future population size from the U.S. Bureau of the Census can be used to establish the denominator of the future ratio and the numerator (i.e., required number of respiratory therapists to provide a constant level of services to the future population) can then be constructed.
>
> Recommendation 5: Refinement of the estimate of future requirements for respiratory therapists should take into account the factors indicated in table 6 to the extent possible. While the direction of such factors on requirements may be clear, the magnitude of the impact has not been determined. Consequently, it is recommended that professional opinions be sought prior to attempting to refine the ratio to permit adjusted future requirements to be calculated.
>
> Recommendation 6: Explicit consideration should be given to the issues of substitutability and complementarity between respiratory therapists and respiratory therapy technicians in developing estimates of future requirements for respiratory therapy services.

Estimating Current Requirements for Respiratory Therapy Technicians: At present, there is no consistent definition of a respiratory therapy technician. Both the lack of well established educational requirements and the apparently small fraction of practitioners who obtain certification contribute to the current state of uncertainty concerning the total supply of respiratory therapy technicians. The first step to the production of reliable estimates of requirements for this profession is a standardized definition of the occupation.

Although the American Associaton of Respiratory Therapists provides data on the number of registered technicians, no reliable and comparable data source was found that would permit the estimation of the total

Table 8.6. Summary of Major Findings from Interviews with Respiratory Therapy Professionals

ISSUES	FINDINGS
Overview	o There is an inadequate supply of respiratory therapy personnel. o Educational requirements for respiratory personnel are increasing. o A major concern is ensuring that respiratory care is conducted by qualified personnel.
Need Factors	o More elderly persons in the population implies the presence of more chronic and acute diseases requiring services. o Improvements and new developments in technology are expanding potential services.
Demand Factors	o The development of additional criteria to document the need for reimbursement of respiratory therapy services will affect the demand for such services. o Third-party reimbursement for services to non-hospital settings will increase demand. o Increasing awareness by physicians of the utility of respiratory care has increased need for such personnel.
Other Factors	o A maldistribution of services may exist in certain areas of the country. o Shifts among employment settings (e.g., fewer in hospitals, more in home health agencies) are expected to occur.

supply of certified and noncertified technicians in all settings. A survey of the total number of respiratory therapy technicians in the hospital sector has been conducted, but the reliability of the estimates cannot be assessed. In summary, there is no continuing reliable source of data on either the total supply of respiratory therapy technicians or the distribution of technicians by employment setting. Consequently, the following specific recommendations for estimation of requirements for respiratory therapy technicians are suggested:

> Recommendation 1(a): If a definition of respiratory therapy technicians is selected which restricts the profession to include only CRTTs, then it is recommended that AART data be used to construct a respiratory therapy technician-to-population ratio for use in assessing requirements for certified respiratory therapy technicians.
>
> Recommendation 1(b): If a definition of respiratory therapy technician is adopted which includes certified and noncertified personnel, then it will be necessary to select the data necessary to construct the ratio. No reliable data are currently available on the total supply of respiratory therapy technicians. Consequently, the choice of this definitional alternative implies that only very rough approximations of requirements for respiratory therapy technicians can be calculated using a personnel-to-population ratio approach.
>
> Recommendation 2(a): If a CRTT definition is selected, then state-level CRTT-to-population ratios should be calculated using AART data. A standard of adequacy can be determined on the basis of a national mean, state-level median, or professional opinion. As was suggested for respiratory therapy, consideration should be given to the presence of existing conditions which may signify a shortage of CRTTs when determining the standard of adequacy.
>
> Recommendation 2(b): If both certified and noncertified persons are to be included in the professional definition, then it is recommended that a national mean respiratory therapy technician-to-population ratio be used as the standard of adequacy. The existing data are uncertain as to reliability and refinement of the national average would be correspondingly uncertain as to reliability.
>
> Recommendation 3: To the extent that the determined standard of adequacy of the respiratory therapy technician-to-population ratio is to be used to assess adequacy of services at a subnational geographic level, consideration should be given to specific conditions in the subnational area which may affect requirements for respiratory therapy technicians. Of particular concern should be such factors as the apparent adequacy of the supply of respiratory therapists and the number and size of potential employment settings. Informed opinion may provide useful input to assessments of this type.

Overall, it should be recognized that estimating requirements for respiratory therapy technicians will be an imprecise exercise at best. The occupation is relatively new and not well defined except for CRTT requirements. In addition, current data availablity and quality are limited. Thus these estimates, if developed, should be used only with great caution.

Estimating Future Requirements for Respiratory Therapy Technicians: The choice of a standard of adequacy for the current respiratory therapy technician-to-population ratio can provide a basis for estimation of future requirements for respiratory therapy technicians. As was discussed above, interviews with persons knowledgeable of the field of respiratory therapy have produced information on factors which would be taken into account in estimating future requirements for this profession (Table 8.6). Thus, the following specific recommendations are offered for estimation of future requirements for respiratory therapy technicians:

> Recommendation 4: The standard of adequacy of the respiratory therapy technician-to-population ratio selected for the estimation of current requirements for respiratory therapy technicians should be used as the foundation for the development of estimates of future requirements for respiratory therapy technicians. Projections of future population size from the U.S. Bureau of the Census can be used to establish the denominator of the future ratio and the numerator (i.e., required number of respiratory therapy technicians to provide a constant level of services to the future population) can then be constructed.
>
> Recommendation 5: Estimation of future requirements for respiratory therapy technicians should be closely coordinated with estimation of future requirements for respiratory therapists. Since the factors cited in table 6 affect requirements for respiratory therapy services provided by both professions, similar assumptions and methodologies should be used for both calculations. Professional opinion should be sought on the issues of complementarity and substitutability between the two professions, in addition to those factors suggested in Table 8.6.

In summary, it should be recognized that definitional problems for this cluster are very severe. Neither credentialing nor work duties can be used to develop clear occupational definitions, since the same wide range of duties is performed by Registered Respiratory Therapists, by Certified Respiratory Therapy Technicians, and by workers with no credentials at all. Therefore, it must be stressed that implementation of the recommendations in this chapter, using available data, may produce relatively acceptable estimates of current and/or future requirements for personnel only if each profession is defined as consisting only of credentialed personnel. However, since it appears that substantial numbers of noncredentialed persons are practicing in this field, estimates of requirements for credentialed personnel only will not produce accurate information on the market demand for respiratory therapy services. Thus, these estimates would have to be used with caution for policy and planning purposes.

Personnel-to-Population Ratios

Thorough review of the information obtained during the conduct of the present study resulted in a conclusion that construction of personnel-to-population ratios was possible for the registered respiratory therapy and certified respiratory therapist technician work force, both at the national level and at the state level. These estimates are presented in Tables 8.7, 8.8, and 8.9.

It is emphasized, however, that these ratios are based only on the credentialed work force. As has been discussed above, there are a substantial number of noncredentialed individuals providing respiratory therapy services. No reliable data are available to permit calculation of personnel-to-population ratios which include this group.

Table 8.7. National Personnel-to-100,000 Population Ratios, Respiratory Therapy Personnel, 1977

Occupation	Total Supply, 1977	Personnel-to-100,000 Population
Registered Respiratory Therapists	6,195	2.9
Certified Respiratory Therapy Technicians	16,707	7.7

SOURCES: (1) 1977 American Association of Respiratory Therapy Survey

(2) U.S. Bureau of the Census

Table 8.8. Registered Respiratory Therapists-to-100,000 Population, by State, 1975

State	Number of Active Registered Respiratory Therapists	Personnel-to-100,000 Population
Alabama	8	.22
Alaska	1	.27
Arizona	35	1.58
Arkansas	11	.52
California	304	1.43
Colorado	38	1.49
Connecticut	58	1.87
Delaware	4	.69
District of Columbia	5	.16
Florida	97	1.17
Georgia	45	.91
Hawaii	6	.69
Idaho	11	1.35
Illinois	155	1.38
Indiana	75	1.41
Iowa	14	.49
Kansas	15	.65
Kentucky	20	.59
Louisiana	25	.65
Maine	37	3.49
Maryland	5	.12
Massachusetts	102	1.75
Michigan	147	1.61
Minnesota	37	.94
Mississippi	14	.59
Missouri	73	1.53

Table 8.8. (Continued)

State	Number of Active Registered Respiratory Therapists	Personnel-to-100,000 Population
Montana	4	.53
Nebraska	12	.77
Nevada	4	.67
New Hampshire	10	1.23
New Jersey	56	.76
New Mexico	9	.78
New York	166	.91
North Carolina	33	.60
North Dakota	6	.94
Ohio	86	.80
Oklahoma	29	1.06
Oregon	24	1.05
Pennsylvania	101	.85
Rhode Island	15	1.61
South Carolina	17	.60
South Dakota	10	1.46
Tennessee	37	.88
Texas	107	.87
Utah	16	1.33
Vermont	5	1.05
Virginia	36	.72
Washington	48	1.34
West Virginia	2	.11
Wisconsin	53	1.15
Wyoming	2	.53

SOURCES: (1) National Board for Respiratory Therapy, Directory of Active Registered Respiratory Therapists, 1975.

(2) U.S. Bureau of the Census.

Table 8.9. Certified Respiratory Therapy Technicians-to-100,000 Population, by State, 1975

State	Number of Active Certified Respiratory Therapist Technicians	Personnel-to-100,000 Population
Alabama	112	3.09
Alaska	4	1.09
Arizona	108	4.88
Arkansas	65	3.08
California	1,310	6.17
Colorado	105	4.13
Connecticut	114	3.67
Delaware	13	2.24
District of Columbia	16	.52
Florida	412	4.97
Georgia	145	2.94
Hawaii	30	3.45
Idaho	27	3.32
Illinois	510	4.55
Indiana	223	4.19
Iowa	80	2.84
Kansas	71	3.11
Kentucky	103	3.04
Louisiana	131	3.44
Maine	40	3.78
Maryland	135	3.27
Massachusetts	320	5.50
Michigan	424	4.65
Minnesota	100	2.55
Mississippi	79	3.37
Missouri	154	3.23

Table 8.9. (Continued)

State	Number of Active Certified Respiratory Therapists Technicians	Personnel-to-100,000 Population
Montana	29	3.88
Nebraska	49	3.17
Nevada	35	5.93
New Hampshire	16	1.97
New Jersey	240	3.27
New Mexico	45	3.93
New York	623	3.44
North Carolina	122	2.24
North Dakota	24	3.76
Ohio	513	4.77
Oklahoma	106	3.90
Oregon	110	4.81
Pennsylvania	301	2.53
Rhode Island	50	5.37
South Carolina	52	1.84
South Dakota	30	4.40
Tennessee	145	3.47
Texas	620	5.06
Utah	38	3.15
Vermont	12	2.54
Virginia	139	2.79
Washington	158	4.43
West Virginia	40	2.22
Wisconsin	184	4.00
Wyoming	7	1.86

SOURCES: (1) National Board for Respiratory Therapy, Directory of Active Registered Respiratory Therapists and Certified Respiratory Therapy Technicians, 1975.

(2) U.S. Bureau of the Census.

Chapter 9
Dietetic Services

OVERVIEW OF THE PROFESSION

Dietetics is a profession that focuses upon the science and art of food and its impact upon the human body and overall health. There is increasing awareness of and concern by the public and the health professions of the importance of a sound knowledge of food and its nutrients. Ensuring the well-being of individuals poses challenging nutrition-related problems. However, only a small number of medical schools offer physicians a comprehensive training program in nutrition. Advancements in nutrition science, influences of food technology on the food supply, and concern over nutrition in the industrial and other sectors are growing phenomena. As a result, there is an increasing role for dietetic personnel within the traditional health care setting as well as a growing role for such professionals within the private sector.

Although there are several health professions which are concerned with aspects of nutrition and diet, the professions with the most specialized and focused knowledge of this area, and of interest for the current effort, are dietitians and dietetic technicians. The practice and functions of dietitians have been described as:

> A dietitian is a health professional trained in applied nutrition and institutional management, whose responsibilities are directed toward the adequate nutritional care of individuals and groups of individuals in institutional and community settings. Functionally, dietitians can be classified as administrative, clinical, community, research, or as educators.[1]

Dietetic technicians work under and with dietitians and food service supervisors/dietetic assistants. Their functions typically include taking diet histories, teaching proper nutritional habits, and evaluating food programs for patients. Additional responsibilities may entail food selection, menu preparation, and counseling activities.[2]

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[1] A Report on Allied Health Personnel. DHEW Publication No. (HRA) 80-28, Nov. 1979, p. VIII-1.

[2] Ibid.

Educational programs in dietetics focus on different areas of study for clinical, community, administrative, and general dietetics. The basic educational requirement for dietitians is a bachelor's degree, with a major in food and nutrition or in institutional management. For dietetic technicians, the basic educational preparation includes graduation from high school and completion of a two-year American Dietetic Association (ADA) approved program resulting in an associate's degree.

Licensure of dietitians is not currently required by any state. The American Dietetic Association has established a system of professional registration and the designation Registered Dietitian for professionally qualified personnel. For the dietitian to qualify for professional recognition, the individual must complete an approved dietetic internship, an approved individual traineeship program, or have completed their bachelor's degree in a coordinated undergraduated program. The Hospital, Institution, and Educational Food Service Society (HIEFSS) is composed primarily of dietetic assistants; however, a small number of dietetic technicians belong to HIEFSS. Dietetic technicians are not required to complete licensure or registration procedures. To be designated as a Certified Dietetic Technician by the HIEFSS, dietetic technicians can take a certification examination given by the society. In addition, dietetic technicians who meet specific educational requirements may belong to the ADA.

The functions of dietitians can be diverse depending upon the type of position held. Administrative dietitians apply knowledge of foods and nutrition and utilize managerial skills to assure that nutritionally adequate foods are served. Traditionally, administrative dietitians have tended to be those in charge of food service systems in large health care settings, commercial establishments, college food services, and in some industrial food centers. They also work in the business and the industrial sector's marketing programs, in senior citizens' food programs, and in public health programs.

Clinical dietitians help individuals or groups of people achieve adequate nutrition by applying the science of nutrition. The clinical dietitian's work involves direct patient care, diet prescription, food selection, and counseling of clients. Clinical dietitians are found in health care facilities rendering primary, secondary and tertiary care. They provide services in hospitals, clinics, public agencies, community health programs, and in private practice to patients usually referred by physicians.

Although differences in the skills and functions of clinical and community dietitians may be hard to discern, the community dietitian tends to perform a broader role. Community dietitians work outside the traditional institutional setting in the capacity of planners, organizers, coordinators, and evaluators of the nutritional component of health care services. They also work in such settings as health organizations, public health programs, in a myriad of federal programs, in developmental and psychiatric areas, and in rehabilitation.

Dietetic educators are responsible for the nutrition education of medical, nursing, dental, and various allied health professionals in addition to the education of dietetic students. The dietetic educator works mainly in the college or university setting or in medical centers. They may also be responsible for educating the public.

Research dietitians evaluate and further knowledge in nutrition, food service, food management, and in the design of food equipment. They are often involved in metabolic research. The research dietitian is usually employed by educational institutions, hospitals or large medical centers with research units, drug companies, the food industry, or the federal government.

Information on the characteristics of dietetic professionals presented in a current survey indicates that the majority (97 percent) of students in dietetics are female. A majority of active Registered Dietitians work in clinical dietetics. Others are employed in teaching, food service, and research positions. In addition, self-employed dietitians with a bachelor's degree earn a higher median salary than dietitians with identical degrees working in colleges or universities, in commercial establishments, or in public health agencies.[3] Reimbursement for dietetic services is available through third-party payers, but reimbursement conditions and levels tend to be erratic.

A profile of the HIEFSS membership indicates that the majority of members are employed in nursing homes and hospitals with very few working in other types of food service.

DEFINITIONAL CONSIDERATIONS

Prior to determining the existing supply or estimating requirements for services provided professionals in the field of dietetic services, consideration must be given to the problem of defining the population.

Dietitians

Due to the strict educational requirements and distinct work roles, the definitions adopted in estimating the supply of dietitians appear to exhibit little variation. In addition, most dietitians are certified. This further strengthens the consistency of the definitions the study population.

According to the American Dietetic Association (ADA), approximately 75-80 percent of dietitians are registered. However, that estimate implies that up to one-fourth of employed dietitians are nonregistered, although functioning as dietitians. The definitional question for this profession, as for others, focuses on registration status of the dietitian. Two alternative definitions are suggested:

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[3] *Ibid*., pps. VIII-2-VIII-4.

(1) "Dietitians" may be defined as those who are employed and who are Registered Dietitians, or who meet the criteria for registration, under the American Dietetic Association standards, or

(2) "Dietitians" may be defined as those individuals who are employed and who perform the functions of a dietitian, whether they are registered or meet the criteria for registration or not.

Dietetic Technicians

At present, there is no clear and universally accepted definition of this profession. This lack of definition can be attributed to two factors. First, unlike the profession of dietetics, educational standards for employment in this occupation are not well established. Second, certification of dietetic technicians is voluntary and only a small proportion of the total work force has sought certification from HIEFSS. Hence, data on the number of HIEFSS-certified dietetic technicians or on ADA members who are dietetic technicians appear to offer little useful assistance for estimation of supply for dietetic technicians. Definition of the occupation is complicated by the fact that dietetic assistants are also employed in this market. It is necessary, therefore, that a definition of the population of dietetic technicians be determined prior to development of estimates of the supply of dietetic technicians. Two alternative definitions are suggested:

(1) "Dietetic technicians" may be defined as those who are employed and who have satisfied all HIEFSS requirements for certification (whether certified or not) or have graduated from an ADA approved Dietetic Technician training program, or

(2) "Dietetic technicians" may be defined as those who are employed and who are defined by their employer as performing the functions of a dietetic technician.

Other definitions may be possible and opinions from practitioners and educators should be sought prior to a final determination of a specific definition of this profession. It is emphasized that an effort should be made to develop a definition which permits clear distinctions between dietetic technicians and other lower-tier workers.

SUPPLY OF DIETETIC SERVICES PERSONNEL

Data sources providing information on this field were identified and assessed. Results and recommendations are discussed separately for dietitians and dietetic technicians, below.

Dietitians

Data Sources: There are eight data sources providing estimates of the supply of dietitians. Estimates from these sources are found in Table 9.1. These sources are:

(1) American Dietetic Association (ADA). ADA releases annual figures of ADA membership and of registered dietitians. ADA also conducts a periodic survey of dietitians, the most recent of which was completed in 1980. While the latter effort does not produce supply estimates, results of the survey include the distribution of employed dietitians by employment setting.

(2) Current Population Survey (CPS). The U.S. Bureau of the Census conducts this monthly survey for the Bureau of Labor Statistics. Data are collected through personal interviews with approximately 65,000 households and include information on occupation and employment setting. Sample results are weighted to produce U.S. totals which appear in the BLS monthly publication Employment and Earnings. Individual occupations falling under CPS's category "dietitian" are those enumerated in the Classified Index of Occupations under Standard Occupation Classification (1970) code 074.

(3) Occupational Employment Statistics Survey (BLS). Data from this survey relevant to this occupation include the total number of registered and nonregistered dietitians, as well as the distribution of personnel by employment setting.

(4) Survey of Hospital Staff (NCHS-SHS). The National Center for Health Statistics conducted this survey in 1977. Results from this survey include the total number of registered and nonregistered dietitians employed in hospitals. Further detail includes the distribution of personnel by full-time/part-time employment status.

(5) National Nursing Home Survey (NCHS-NNHS). This survey, also conducted by the National Center for Health Statistics, contains information on the supply of registered and nonregistered dietitians employed in nursing homes. The distribution of personnel by full-time/part-time employment status is also among the results. It should be noted that an attempt was made to include all persons employed in nursing homes on a contractual basis. This leads to the possibility that persons working part-time in more than one institution will be counted in each place of employment.

(6) Allied Health Employment Matrix (AHEM). The AHEM project was conducted for the Bureau of Health Professions by Applied Management Sciences. Estimates of the supply of dietitians represent full-time equivalent (FTE) employment in all settings of all registered and nonregistered dietitians in 1976. Of the 31 states providing dietetic data for AHEM, 26 remained acceptable after technical screening. These states represent all of the nine Census regions, and comprised 58.3 percent of the 1976 United States population.

TABLE 9.1. ESTIMATES OF THE SUPPLY OF DIETITIANS BY DATA SOURCE AND EMPLOYMENT SETTING [1]

	DATA SOURCE						
EMPLOYMENT SETTING	ADA[2] (1980)	NCHS-SHS[3] (1977)	NCHS-NNHS[3] (1977)	AHEM[4]	AHA (1976)	CPS (1979)	CENSUS
Total	36,226			22,000- 24,000		57,000	40,131
Hospitals/	14,019	11,700 FT 2,900 PT			9,377		26,534
Nursing Homes	2,246		2,900 FT 10,300 PT				3,339
All Others	19,961						10,258

[1] BLS estimates do not appear because they were not available for publication at the time that this report was being prepared.

[2] ADA total is from annual membership survey. Breakdown by employment setting is from 1980 Survey of Membership which includes only active members.

[3] Includes nutritionists.

[4] Full time equivalent.

(7) Survey of Selected Hospital Manpower (AHA). The American Hospital Association conducted this survey in 1966, 1969, and 1973. Results from this survey include the total number of registered and nonregistered dietitians employed in hospitals. The distribution of personnel by full-time/part-time employment status is also available, as is a summary FTE figure.

(8) Census of Population (Census). The U.S. Bureau of the Census conducts a decennial Census of Population, mandated by the U.S. Constitution. A 20 percent sample of the U.S. population responds to questions about their employment, including their occupation and employment setting. Data are currently available from the 1970 census.

Data Assessment: The evaluation of the estimates of the supply of dietitians is summarized in Table 9.2. Four data sources provide estimates of the total supply of registered and nonregistered dietitians: BLS, AHEM, Census and CPS. Examination of the census public use sample data for this occupation indicates that the self-reporting nature of the data collection instrument has introduced an upward bias. A number of individuals were identified who did not have the minimum educational requirements for the occupation classified themselves as dietitians. Thus, the resulting estimate of 40,000 dietitians in 1970 appears to include lower-tier dietitic workers such as technicians, assistants, and aides.

The CPS estimate of 57,000 dietitians in 1979 appears, also, to reflect an upward self-reporting bias. The effect of the bias on CPS data for this occupation is not quite as serious as that for Census. This may be due to the fact that trained interviewers administer the questionnaire and are, therefore, able to clarify questionable reponses by asking further questions. Nevertheless, the estimate is inconsistent with estimates from other sources.

AHEM's estimate of 22-24,000 FTE dietitians in 1976, when expressed in terms of total workers rather than full-time equivalents, appears to be in approximate agreement with the BLS estimate. Upon closer scrutiny, however, the AHEM estimate is found to be based upon an assumption whose accuracy cannot be verified. Fourteen of the 26 AHEM states reported a total number of employees, which was then converted to full-time equivalents based on data from New Jersey. The New Jersey data indicate that one-half of the work force of dietitians works part-time. This fact is not substantiated by the other sources, thus, the accuracy of the AHEM result must be discounted. This leaves no estimate with which to compare the preliminary, unpublished BLS estimate. Therefore, the accuracy of the BLS estimate also cannot be verified.

The ADA presents an accurate estimate of the total numbers of active and associate members and registered non-members. However the utility of this estimate is limited by the fact that the relationship between the total supply of employed dietitians and this estimate is unknown.

Table 9.2. CONSISTENCY OF ESTIMATES OF ACTIVE DIETITIANS

Data Source	Coverage	Periodicity	Consistency of Estimate
ADA	ADA Members and Registered Nonmembers, Total Supply and by Employment Setting	Annual, most recently in 1980	Consistency not assessable.
CPS	Registered and Nonregistered Dietitians, Total Supply	Monthly, most recently in 1979	Inconsistent with other estimates for total supply.
BLS	Registered and Nonregistered Dietitians, Total Supply and by Employment Setting	Triennial, most recently in 1978	Consistency not assessable.
NCHS-SHS	Registered and Nonregistered Dieticians in Hospitals	1977	Consistent with ADA and BLS for hospitals. Inconsistent with AHA for hospitals.
NCHS-NNHS	Registered and Nonregistered Dieticians in Nursing Homes	1977	Inconsistent with BLS, and Census for nursing homes.
AHEM	Registered and Nonregistered Dietitians, Total Supply	1976	Inconsistent with other estimates for total supply.
AHA	Registered and Nonregistered Dietitians in Hospitals	1973	Inconsistent with ADA, BLS, NCHS-SHS and Census estimates for hospitals.
Census	Registered and Nonregistered Dietitians, Total Supply and by Employment Setting	Decennial, most recently in 1970	Inconsistent with other estimates for total supply.

While there are also no consistent estimates of employment in the hospital sector, both the preliminary, unpublished BLS and ADA data estimate that between 40 and 45 percent of the work force is employed in this setting. Census, on the other hand, estimates that two-thirds of the work force of dietitians are employed in hospitals.

In summary consistent data are available only for Registered Dietitians. Even though the other sources have attempted to measure the total population, they have used different criteria for inclusion in the occupation. The accuracy of the estimates from other data sources is not assured until additional independent estimates can verify the currently existing data.

Summary and Recommendations: While there are several sources of data providing continuously updated estimates of the work force of dietitians, the accuracy of most of these data is not asssured. ADA provides accurate estimates of the registered dietitians; however, the percentage of all employed dietitians who have earned credentials is unknown. Therefore, the following specific recommendations for estimation of the supply of dietitians are suggested:

> Recommendation 1(a): The total supply of Registered Dietitians should be estimated using the continuous, reliable data available from the American Dietetic Association.
>
> Recommendation 1(b): Before collecting any further data on the size of the work force of all registered and nonregistered dietitians, definitional guidelines for this occupation should be established. These guidelines will serve to distinguish the population of dietitians from that of lower-level dietetic support staff (e.g., dietetic technicians, assistants, and aides). Examination of the 1970 census public use sample indicates that a large number of the cases which appear to have been misclassified as dietitians could have been identified by examining the education of the respondents. In other words, further investigation into those cases of "dietitians" reporting less than a minimum number of years of schooling could help to identify misclassifications. This type of cross-checking could be easily incorporated into standard consistency edits in the Census of Population or Current Population Survey. These two data sources would provide continuously updated information on the supply of dietitians. Further, the Census of Population provides the distribution of personnel by employment setting.
>
> Recommendation 2: If an independent accurate estimate is identified to assure the consistency of the BLS estimate of the supply of dietitians, then BLS data should be used as a continuously updated source of consistent data on the supply of dietitians.

Dietetic Technicians

Data Sources: There are five data sources providing information on the size of the dietetic technician work force. Estimates from these sources may be found in Table 9.3. These data sources are:

(1) American Dietetic Association (ADA). The ADA produces annual figures on the supply of DTs. Because this is a relatively recent designation, only a small portion of the work force has, to date, qualified for the title.

(2) Occupational Employment Statistics Survey (BLS). This triennial survey provides estimates of the supply of dietetic technicians, regardless of certification status, by employment setting.

(3) Survey of Hospital Staff (NCHS-SHS). This NCHS survey contains information on the supply of credentialed and noncredentialed dietetic technicians employed in hospitals in 1977. Further detail from this survey includes the distribution of dietetic technicians according to full-time/part-time employment status.

(4) Allied Health Employment Matrix (AHEM). AHEM received data on dietetic technicians from 12 states. After screening, 10 states remained representing 26.3 percent of the U.S. population. Seven of nine Census regions are represented in these states. Given that over a quarter of the country is included in the sample, and that there is good geographic representation, a reliable estimate may be assumed from AHEM. There is evidence, however, that some sample states may have reported only DTs while others have included all persons employed as dietetic technicians. Therefore, biases inherent in the sample may have produced misrepresentative results.

(5) American Hospital Association (AHA). The AHA data include estimates of the supply of dietetic technicians employed in hospitals in 1973. This survey was similar to those conducted by AHA in 1966, and by AHA with NCHS in 1969. Further detail from this survey includes the distribution of personnel by full-time/part-time employment status. A summary full-time equivalent employment figure is also provided.

In summary, it appears that there are no consistent, comprehensive estimates of the current total supply and/or distribution by employment setting of dietetic technicians.

Data Assessment: The consistency of the estimates of the supply of dietetic technicians is summarized in Table 9.4. There are currently no data available on the supply of dietetic technicians whose accuracy can be assured. Only one data source--AHEM--attempts to measure the entire work force of dietetic technicians. AHEM reports that some sample states were unclear as to the definition of the population used (i.e., the estimates may or may not represent all crendentialed and noncredentialed personnel), leaving the accuracy of the resulting estimate in question.

TABLE 9.3. ESTIMATES OF THE SUPPLY OF DIETETIC TECHNICIANS BY DATA SOURCE AND EMPLOYMENT SETTING[1]

EMPLOYMENT SETTING	DATA SOURCE			
	ADA[2] (1980)	NCHS-SHS (1977)	AHEM (1976)	AHA (1973)
Total	596	14,900 FT	23,000 27,000 FTE	
Hospitals		14,900 FT 2,300 PT		16,102 (15,408 FTE)

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[1] BLS estimates do not appear because they were not available for publication at the time that this report was being prepared.

[2] DTs only.

Table 9.4. CONSISTENCY OF ESTIMATES OF ACTIVE DIETETIC TECHNICIANS

Data Source	Coverage	Periodicity	Consistency of Estimate
ADA	Registered Dietetic Technicians Only, Total Supply	Annual, most recently in 1980	Inconsistent with BLS and AHEM estimates.
BLS	Total Registered and Nonregistered Dietetic Technicians, Total Supply and by Employment Setting	Triennial, most recently in 1978	Inconsistent with AHEM and ADA estimates. total supply.
NCHS-SHS	Total Registered and Nonregistered Technicians and Assistants in Hospitals	1977	Consistency not assessable.
AHEM	Total Registered and Nonregistered Technicians, Total Supply	1976	Inconsistent with ADA and BLS estimates for total.
AHA	Total Registered and Nonregistered in Hospitals (Includes Food Service Managers, Technicians, and Assistants)	1973	Consistency not assessable due to unique coverage.

ADA provides an adequate count of credentialed dietetic technicians. However, since this represents such a small part of the work force, the data are not useful in estimating the total supply of dietetic technicians.

Due to the fact that the preliminary, unpublished BLS data are presently incomplete, i.e., employment in the hospital sector is not estimated, this source's accuracy is currently unassessable. The assessment of this data source should be attempted again when the results for the hospital sector are available.

There is apparent agreement between the two estimates of dietetic technician employment for the hospital sector. Both NCHS-SHS and AHA report approximately 15,000 FTE technicians employed in hospitals. However, the earlier AHA surveys show growth in this profession from 6,000 to 18,000 from 1967 to 1969, and then a decrease to 16,000 in 1973. Thus, the internal consistency of the AHA results is questionable.

Using only the five available data sources, there appears to be no reliable means by which to estimate the total supply of dietetic technicians. There are, in practice, as many definitions as data sources for this occupation.

Summary and Recommendations: The most important issue prohibiting the collection of reliable estimates of dietetic technicians is the lack of a consistent definition of the occupation. Further data collection efforts or estimation procedures will be of little use until a standard definition of the occupation is established.

Therefore, the following recommendations are provided to assist in this effort:

> Recommendation 1: A standard definition of this occupation may be developed by means of a well constructed role delineation study of the profession. The role delineation study could consist of the administration of an in-depth questionnaire mailed to a randomly selected sample of dietitians and dietetic support personnel (e.g., technicians, aides, and assistants) employed in selected settings (e.g., hospitals, nursing homes). The survey would attempt to elicit detailed information on:
>
> - job activities
> - job responsibilities
> - job title
> - educational background
> - credential status
> - occupational training

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in order to construct a profile of the different categories of employees working within the profession. The American Dietetic Association is currently planning to conduct such a role delineation study. The results of any such study should be monitored and used to establish criteria for defining the population for which information is sought (i.e., dietetic technicians).

Recommendation 2: If a well defined occupational category can be constructed, the final step would be to include the category in ongoing data collection efforts that currently provide continuous, reliable estimates for other allied health occupations such as the Bureau of Labor Statistics' Occupational Employment Statistics survey or the Census Bureau's Census of Population or Current Population Survey.

REQUIREMENTS FOR DIETETIC SERVICES PERSONNEL

The derivation of appropriate criteria to indicate requirements for dietitians and dietetic technicians was conducted in several parts: (1) interviews with knowledgeable professionals to identify factors affecting current and future supply for dietetic services; (2) evaluation of the consistency and availability of data on supply of each profession; (3) development of recommendations for estimating current and future requirements for dietetic services providers, and (4) construction of personnel-to-population ratios, using the most reliable data available.

Interviews with Dietetic Services Personnel

A full description of the purpose, structure, and methodology used for the interviews has been presented in Chapter 2. This section contains a description of the selected interviewees, a summary of results, and a discussion of implications.

Description of Interviewees: Telephone interviews were conducted with a small sample of nine participants who were chosen based upon their familiarity with current trends in the field of dietetics, their knowledge of particular issues, and/or their geographic diversity. Table 9.5 shows the geographic and categorical distribution of the nine participants.

The two participants interviewed from the American Dietetic Association perform different functions within the organization; one has responsibility for administrative and research activities and the other, a Registered Dietitian, has expertise in the area of management. The participant from the Hospital, Institutional, and Educational Food Service Society was interviewed in order to gain perspective about the needs and demands for dietetic assistants.

TABLE 5: MATRIX OF CHARACTERISTICS OF DIETETICS PROFESSIONALS INTERVIEWEES

	GEOGRAPHIC REGION			
CATEGORY	NORTHEAST	NORTH CENTRAL	SOUTH	WEST
Association		XXX		
Academic	XX		X	
Employer/Supervisor		X		
Practitioner			X	X

The three academic professionals interviewed are affiliated with major universities located in the southern and northern regions of the country. Their length of experience in the academic area varies considerably. One is a Registered Dietitian who has been working in the nursing and allied health areas for the past 15 years. The other two individuals are Registered Dietitians teaching at their respective universities for shorter time periods.

One Director of Dietetics was chosen to participate in the interviews. This dietetic supervisor oversees a large staff in a university hospital. Both practitioners interviewed are Registered Dietitians working in small community hospitals.

Results: A major consensus emerging from the nine telephone interviews is that a shortage of dietetics professionals exists. The perceived expectation of future shortages included such indicators as:

- Projections by the ADA which estimate a shortage of dietitians that will continue into 1990.
- Substantial numbers of vacancies in rural areas which go unfilled.

There was general agreement among most interview participants that educational requirements for personnel have changed in recent years. As a few participants pointed out, new programs are now incorporating more technical, economic, and management skills into the overall education of dietary professionals in order to help them better meet today's dietary needs. Students graduating with these skills should have little problem in finding appropriate employment, according to several interviewees.

The intrinsic value of the current credentialing process and its effect on the overall quality of job performance is an issue raised by professional and academic participants. Whether or not mandatory licensure would affect the supply and quality of available services was a matter of debate. The arguments for mandatory licensure as a credentialing procedure preferable to certification involved several issues. It was noted that the public may better understand the value of licensure and that it is difficult to write certification into federal and state legislation. It was also pointed out that getting certification written into job descriptions for dietetic personnel may be a difficult task.

Some form of credentialing is believed to ensure the quality of services since, at some point of entry into the profession, the competency of personnel is documented. Certification is also perceived as preferable to licensure since it applies on a national rather than state-by-state level. A related issue is that regulatory agencies are examining the requirements for personnel and the services they provide. This suggests that there will be a need for justification to regulatory agencies of the value of services provided by professionals in this field, according to several interviewees.

The appropriate utilization of dietetics staff was a concern expressed by several of the professionals. According to the participant from HIEFSS, dietetic assistants are still not utilized properly and HIEFSS is working to increase recognition of these professionals by administrators and dietitians. It was also pointed out that a clear professional definition of each of the types of services a dietetic professional can provide is needed. Professional distinctions need to be clarified as educational emphasis differs.

It was stated that the future of dietetic services in the hospital setting is dependent upon economic conditions. It is interesting to note that two of the registered dietitians pointed to increasingly positive attitudes toward the field of dietetics, especially within the medical community. However, they acknowledge that many older physicians are not fully cognizant of what type of services, and the benefits of services, a dietitian can provide. Concern was expressed that there exists a need to educate physicians as well as patients.

Factors Affecting Needs-Based Estimates. The medical needs-based approach to estimating health personnel requirements is frequently described as representing the services required for a given population, with specific characteristics, in order to maintain an optimal level of health. The major usefulness of the medical needs-based approach to estimating requirements is that it is a methodology for estimating a maximum work force level required, when a range of values is desired for planning or other purposes.

The interview participants were in agreement on several factors which have had an impact on the need for services of dietitians and dietetic technicians. One factor is the changing age/structure of our society, (e.g., a population that is becoming older) which affects the dietetic needs of the population. As more older persons are being placed in long-term care facilities, dietetics personnel will be needed to provide more nutritional assessments and counseling services in these facilities.

Several interviewees stressed that technological changes and changing perceptions about the importance of nutrition within the medical community and the public's awareness of nutrition have affected current and future educational requirements and overall need for dietetic services. New opportunities to provide dietetic services to neonatal and cancer patients, and other groups, have emerged. There is also a growing need for trained individuals who can apply equipment technology (such as the microwave process) and who have the technical ability to assess cost/quality tradeoffs when making purchases.

Factors Affecting Demand-Based Estimates. Needs criteria, examined alone, will not fully identify those areas with excess or insufficient dietetics health care resources. Demand-based estimates utilizing the economic approach, on the other hand, refer to both the individual's wants and the individual's ability to pay for goods and services.

Interview participants stated that demand for dietetic services has been strongly influenced by such factors as legislation and reimbursement policies. The expansion of requirements for registered practitioners in long-term care facilities under the guidelines set up by the federal government has increased the demand for dietetics personnel. Federal legislation has created new employment opportunities for dietetics personnel in public health through such programs as Maternity and Infant Care Projects, Children and Youth Projects, and the Supplemental Food Program for Women, Infants and Children (WIC).

According to several interview participants, inadequate third-party reimbursement for professional services has tended to limit the growth of private and non-institutional practice. Hospital-based services are usually covered under the daily rate for hospital costs. However, the small percentage of dietitians operating in private practice or working on a referral basis are reimbursed erratically through private third party payers. Limited coverage under Medicare and Medicaid also prevents many persons with need for dietetic consultations from obtaining such services.

The market for dietetic personnel has been affected by other factors. Most interview participants agreed that greater public sophistication and more effective advocates in nutrition have influenced the demand for dietetic services as more people realize the value of proper nutrition. In addition to an increased public awareness of the appropriate uses of dietetic services is the increased awareness and utilization of these professionals by physicians and facility administrators. The underutilization of dietetics professionals in some hospital facilities and private industry, in the past, was due to a lack of full understanding of the benefits of dietetic services.

Marketing activities by the professional associations representing dietetics professionals also affects demand as physicians, employers, and consumers become aware of the potential services dietetic personnel can provide. Participants from both associations believe that awareness of the role of dietetics personnel in the health professions has not yet reached an appropriate level. Public and health professionals need to become better acquainted with the intrinsic value of these services. Both professional associations recognize the need to promote their profession through more vigorous marketing efforts.

Other Considerations. Several other factors which could affect requirements estimation for the dietetics profession were noted by the interviewees.

Several interviewees pointed out that a maldistribution of dietetics professionals exists. Dietetics employment tends to be facilities-oriented. Although consumer need may exist in rural areas and in small communities, the work force tends not to be drawn to such areas unless appropriate facilities are available. Furthermore, there is an unmet demand for dietetic personnel in smaller communities and in rural areas due to as apparent reluctance on the part of personnel to live in these areas.

Another consideration relevant to estimates of requirements for dietetic services is the changing distribution of personnel among employment settings. Dietetic professionals may be less frequently employed in hospital-based settings, in the future, as more professionals accept positions in private industry and in home health agencies.

Another concern to the profession, according to several of the participants, is the relationship between disciplines and changes in role delineation of dietetic professionals. The role of the dietitian relative to that of the dietetic technician and dietetic assistant is an issue, among others, that is being explored by the professional associations.

Summary: Results of the interviews provide information on some of the factors affecting current and future requirements for dietetic services from the perspective of professionals actively involved with the issues of dietetics practice. Major issues emerging from these interviews are highlighted in Table 9.6. Overall, the professionals interviewed were optimistic about the future, anticipating substantial increases in demand for dietetic services, within traditional settings as well as in new settings.

Several areas for future research were also identified in these interviews. Research is needed to provide a more quantitative and qualitative examination of the field of dietetic services to provide information necessary to make accurate estimation of requirements for services.

Several other areas for future research were also identified in these interviews, including:

- Studies to determine the need for services, including examination of cost/benefit relationships between dietetics consultations and outcomes.
- Examination of the issue of ensuring that services are provided by qualified personnel meeting Federal standards is necessary.

The factors identified in this report, and other relevant issues and variables affecting requirements for dietetics personnel, are discussed in detail in the occupation-specific sections below. The recommendations developed and presented in that report are based upon the results of the literature review, assessment of data adequacy, and the information gained through the interviews conducted and reported here.

Recommendations for Estimating Requirements for Dietetic Services Personnel Dietitians

Estimating Current Requirements for Dietitians: The general recommendation proposed in Chapter 2 of this report is that a personnel-to-population ratio approach be used to develop current

TABLE 9.6: SUMMARY OF MAJOR FINDINGS FROM INTERVIEWS WITH DIETETIC PROFESSIONALS

ISSUE		FINDINGS
Overview	o	There is an inadequate supply of dietetic personnel and this shortage is expected to persist since current annual educational output will not permit the work force to grow at an adequate rate that would meet future needs.
	o	The current credentialing system's value is an issue of debate.
Need Factors	o	As more elderly citizens are being placed in long-term care facilities, the need for additional dietetic personnel increases.
	o	Developments in technology are expanding the potential services available.
Demand Factors	o	Legislation has had a substantial impact on demand for dietetic services.
	o	Third party reimbursement for services is limited but has the potential to increase demand.
	o	Increasing public awareness and awareness of the medical community of the benefits of dietetic services will influence demand.
Other Factors	o	Maldistribution of services exists, being most apparent in smaller communities and rural areas.
	o	Shifts in the distribution of personnel among employment settings are expected.
	o	Role delineation among dietetic professions and specialties is an issue of concern.

requirements estimates. Definitional considerations and data availability make this general recommendation a feasible one for this occupation. Consequently, the following specific recommendations for estimation of current requirements are provided:

> Recommendation 1: State-level dietitian-to-population ratios may be constructed using data from ADA or from BLS, after the definition of dietitian to be used has been selected. However, since it has not been possible to assess the consistency of these data sources, resulting estimates must, necessarily be viewed as potentially unreliable.
>
> Recommendation 2: Determination of a standard of adequacy for the dietitian-to-population ratio should be made. A national mean or a state median value may be selected. Since use of a national average would incorporate any existing shortages into the requirements estimate, it is recommended that determination of the standard of adequacy take into account any existing evidence on the presence of a current shortage (e.g. number of job vacancies, rate of increase in salary levels).
>
> Recommendation 3: Use of the dietitian-to-population ratio standard of adequacy to assess whether subnational geographic regions have sufficient dietitians to meet existing requirements should take into account characteristics of the subnational region in determining whether an excess or shortage of dietitians exists.

Estimating Future Requirements for Dietitians: The dietitian-to-population ratio and the standard of adequacy selected to estimate current requirements for dietitians will provide the basis for estimation of future requirements for dietitians.

One alternative approach to estimating future requirements is to assume that the dietitian-to-population ratio standard of adequacy represents the minimum level of future requirements. Therefore, projected increases in the population require that proportional increases in the numerator of the ratio occur.

Dietetic Technicians

Estimating Current and/or Future Requirements for Dietetic Technicians: Review of definitional considerations and the availability and quality of data or the supply and distribution of dietetic technicians leads to the conclusion that it is not possible at the present time to estimate current or future requirements for this profession using a personnel-to-population ratio approach. The lack of definitional consistency among the various data sources available implies that it is not feasible to select a data source for the numerator of the ratio. Consequently, the following alternative recommendations for estimating requirements for dietetic technicians are proposed:

Recommendation 1: Current estimates of requirements for dietetic technicians should be derived from the estimate of current requirements for dietitians. To implement this recommendation, it will be necessary (1) to develop a clear functional definition of the population; and (2) to constitute a panel of experts to provide informed opinion on the relationship between the number of dietitians and the complementary number of dietetic technicians required, total and in different employment settings.

Recommendation 2: Estimation of future requirements for dietetic technicians should be based upon the same methodology developed under Recommendation 1. Again, informed opinion should be obtained to ensure that factors which are expected to affect future requirements for dietetic technicians differently from dietitians, are taken into account.

It should be stressed that implementation of these recommendations will produce an estimate of requirements for dietetic technicians which is somewhat more subjective in nature than are estimates for other occupations which are based on an adjusted personnel-to-population ratio. However, at the present time no other approach is feasible. If, in the future, reliable data become available on the supply and distribution of dietetic technicians, development of requirements estimates based on an adjusted personnel-to-population ratio may be considered.

Personnel-to-Population Ratios

Review of the findings of this study reveals that the construction of personnel-to-population ratios, at the national and the state levels is feasible for Registered Dietitians. Results of these calculations are presented in Table 9.7, 9.8 (AHEM, selected states), and 9.9 (NCHS, all states).

It is not possible, at the present time, to develop personnel-to-population ratios for dietetic technicians. As was discussed above, no reliable or consistent data are available for this occupation.

TABLE 9.7: NATIONAL PERSONNEL-TO-100,000 POPULATION RATIOS, REGISTERED DIETITIANS, 1980

Occupation	Total Supply, 1980	Personnel-to-100,000 Population
Registered Dietitians	31,358	13.85

SOURCES: (1) American Dietetic Association 1980 estimate

(2) U.S. Bureau of the Census, 1980 Census of Population

TABLE 9.8: DIETITIANS-TO-100,000 POPULATION, SELECTED STATES, 1976

State	Year of Reported Data	Employment Settings Reported	Form*	Estimated 1976 FTE Employment	Estimated FTE Personnel-To-Population Ratio (per 100,000)
Colorado	1975	All, except hospitals	Total	196.2	5.4
Connecticut	1973	Hospitals; nursing homes	FTE	407.2	13.1
Georgia	1975	All, except hospitals	Total	426.8	8.6
Idaho	1977	Hospitals	FT/PT	54.1	6.5
Illinois	1974	Hospitals	FTE	1,072.5	9.6
Indiana	1975	All, except hospitals	Total	425.7	8.0
Iowa	1976	All	Total	194.1	6.8
Maine	1975	All, except hospitals	Total	199.1	18.6
Maryland	1974	All	Total	602.4	14.5
Massachusetts	1975	Hospitals	FT/PT	1,383.6	23.8
Minnesota	1975	Hospitals	FT/PT	602.3	15.2
Mississippi	1975	All, except hospitals	Total	165.7	7.0
Missouri	1975	All, except hospitals	Total	278.3	5.8
Montana	1977	Hospitals; nursing homes	FT/PT	38.1	5.1
Nebraska	1976	Hospitals	FTE	173.8	11.2
New Hampshire	1973	All	Total	54.2	6.6
New York	1975	All, except hospitals	Total	1,263.8	7.0
North Carolina	1977	Hospitals; nursing homes	FT/PT	457.6	8.4
Oklahoma	1975	Hospitals; nursing homes	Total	318.8	11.5
Oregon	1974	All	Total	173.6	7.5
Texas	1973	Hospitals; nursing homes	FT/PT	1,536.8	12.3
Utah	1975	All, except hospitals	Total	108.3	8.8
Virginia	1974	Nursing homes	FTE	401.5	8.0
Washington	1974	All	Total	279.2	7.7
Wisconsin	1975	Nursing homes	FT/PT	1,301.5	28.2

SOURCES: (1) AHEM estimates

(2) U.S. Bureau of the Census

TABLE 9.9: DIETITIANS-TO-100,000 POPULATION, ALL STATES, 1977

State	Number of Employed American Dietetic Association Members	Personnel to-100,000 Population
Alabama	343	9.29
Alaska	34	8.17
Arizona	322	13.78
Arkansas	168	7.8
California	2,779	12.69
Colorado	472	17.97
Connecticut	417	13.39
Delaware	73	12.54
District of Columbia	138	20.14
Florida	824	9.73
Georgia	422	8.37
Hawaii	141	15.81
Idaho	111	12.97
Illinois	1,366	12.15
Indiana	527	9.85
Iowa	421	14.57
Kansas	358	15.42
Kentucky	295	8.50
Louisiana	420	10.69
Maine	86	7.93
Maryland	632	15.27
Massachusetts	880	15.22
Michigan	887	9.65
Minnesota	643	15.99
Mississippi	187	7.83
Missouri	598	12.40
Montana	107	13.7
Nebraska	271	17.43
Nevada	50	7.84
New Hampshire	109	12.77
New Jersey	651	8.86
New Mexico	133	11.11
New York	1,759	9.80
North Carolina	413	7.48
North Dakota	102	15.67
Ohio	1,404	13.12
Oklahoma	297	10.54
Oregon	320	13.41
Pennsylvania	1,196	10.13
Rhode Island	117	12.48

TABLE 9.9: (Continued)

State	Number of Employed American Dietetic Association Members	Personnel to-100,000 Population
South Carolina	152	5.28
South Dakota	85	12.35
Tennessee	430	10.01
Texas	1,262	9.85
Utah	169	13.30
Vermont	67	13.81
Virginia	538	10.54
Washington	575	15.62
West Virginia	113	6.09
Wisconsin	727	15.65
Wyoming	45	11.08

SOURCE: U.S. Department of Health, Education, and Welfare. *Health Resources Statistics, Health Manpower and Health Facilities*, 1976-77 Edition.

Chapter 10
Clinical Laboratory Services

OVERVIEW OF THE PROFESSION

Clinical laboratory services providers perform vital functions in the detection, diagnosis, and treatment of illness. Nearly 5 billion tests are conducted annually at a cost of more than $12 billion--about 10 percent of the nation's yearly expenditure on medical care.[1]

To assist in the diagnosis and treatment of illness, clinical laboratory personnel must utilize a variety of skills associated with different types of education and experience. These personnel collaborate with physicians, pathologists, clinical chemists, and assorted scientists with degrees in chemistry, microbiology, or other biological sciences. In the regular conduct of laboratory procedures, an array of modern electronic equipment and precision instruments is utilized.

The types of education and training required for effective performance of their duties by individuals employed in clinical laboratories varies greatly. A number of individuals employed are college graduates with varying combinations of formal education or with vocational school training or apprenticeship training in a clinical laboratory. Training for clinical laboratory personnel ranges from extensive and formal to lesser degrees of educational and work experience. This discussion focuses on three categories of these personnel: (1) medical technologists; (2) medical laboratory technicians; and (3) cytotechnologists.

Medical technologists function as highly skilled laboratory scientists supervising or performing tests and procedures in hematology, bacteriology, serology, immunology, clinical chemistry, blood banking, urinalysis, mycology, and parasitology. Some medical technologists serve as laboratory supervisors or assist in the training of student medical technologists and other laboratory personnel. Medical technologists trained at the baccalaureate or master's degree level are generally in supervisory positions, particularly in the larger hospital setting.

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[1] *A Report in Allied Health Personnel*. DHEW Publication No. (HRA) 80-28, Nov. 1979, p. VI-1.

Credentialing of medical technologists is entirely voluntary. Four organizations offer credentials for this occupation.

Medical Laboratory Technicians usually work under the supervision of a medical technologist, laboratory supervisor, or clinical laboratory scientist. They perform laboratory tests in chemistry, hematology (blood counts and blood cell identification), urinalysis, blood banking (routine typing and cross-matching, immunological tests for the detection of antibodies), microbiology (antibiotic susceptibility testing), and parasitology (organism identification). They utilize instruments such as highly sophisticated automated blood analyzers and microscopes.

Currently, there are four organizations responsible for the certification of medical laboratory technicians.

Cytotechnologists specialize in detecting the presence of cellular disease through microscopic examination of cell samples. In their search for abnormalities of cell specimens, cytotechnologists screen the nature and extent of disease and resultant cellular damage. These personnel incorporate a variety of laboratory procedures such as special staining techniques, enzymatic techniques, and electron microscopy.

Credentialing of cytotechnologists is the responsibility of one organization.

DEFINITIONAL CONSIDERATION

Prior to determining the existing supply or estimating requirements for services provided by clinical laboratory health personnel it is essential to define the population involved.

Medical Technologists

The various data sources in Table 10.1 appear to be in agreement as to the general size of the population in question. However, the sources are divided into two groups: (1) those which collect data on certified workers, and (2) those which collect data on both certified and noncertified workers. Before estimating the supply of medical technologists, it will be necessary to choose a definition of the population of medical technologists. Two alternative definitions can be proposed for this population:

(1) "Medical technologists" may be defined as those individuals who are employed and who have received certification through the completion of educational requirements leading to a baccalaureate degree and at least one year of clinical training in an accredited program; or

TABLE 10.1. ESTIMATED SUPPLY OF ACTIVE MEDICAL TECHNOLOGISTS BY EMPLOYMENT SETTING AND DATA SOURCE[1]

	DATA SOURCE					
EMPLOYMENT SETTING	ASCP[2] (1980)	NCHS-SHS (1977)	CDC-ASMT[3] (1976)	AHEM[4] (1976)	AHA (1973)	ASMT-CENSUS[3] (1971)
Total	113,439			77,000-85,000		
Hospitals/ Laboratories		53,200 FT	76,326 10,700 PT		46,644 (42,120.5 FTE)	43,427
All Others						

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[1] BLS estimates do not appear because they were not available for publication at the time that this report was being prepared.

[2] Includes ever-certified MT's(ASCP).

[3] Certified personnel only.

[4] Full time equivalent (FTE).

(2) "Medical technologists" may be defined as the total supply of persons (certified and noncertified) performing the work duties designated as those of medical technologists.

In either case, the data should be collected in a manner which would permit identification of those persons who are subspecialists in medical technology (e.g., microbiology technologists or hematology technologists) even though they may be trained and have been credentialed as medical technologists prior to specialization.

Medical Laboratory Technicians

There is no generally accepted definition for medical laboratory technicians. Aside from the fact that only a small proportion of the entire work force holds certification, the role of medical laboratory technicians appears to be interchangeable or confused with that of lower-level support staff in laboratories (e.g., laboratory aides and assistants). As will be discussed below, there is no consistency among the estimates of the total or certified work force, nor are consistent estimates of medical laboratory technicians available by employment setting. Hence, it seems likely that definitional differences play a role. It is clear that an improved definition of this profession is a critical step prior to estimation of supply for this category of personnel. Two alternative definitions could be considered:

(1) "Medical laboratory technicians" may be defined as those who are employed and are certified medical laboratory technicians; or

(2) "Medical laboratory technicians" may be defined as all certified and noncertified personnel functioning as medical laboratory technicians.

Use of the latter definition would require that laboratory aides and assistants be separable from technicians to avoid inclusion of lesser trained workers in the supply estimate.

Cytotechnologists

As was the case for the other occupations in this cluster, the definitional alternatives observed for this occupation involve certification status. These alternatives include:

(1) "Cytotechnologists" may be defined as those persons who are employed and are certified cytotechnologists; or

(2) "Cytotechnologists" may be defined as all certified and noncertified personnel functioning as cytotechnologists.

SUPPLY OF CLINICAL LABORATORY SERVICES PERSONNEL

Data sources providing information on the supply of medical technologists, medical laboratory technicians, and cytotechnologists were identified and assessed. Results and recommendations are discussed separately for each occupational group.

Medical Technologists

Data Sources: Seven data sources provide information on the supply of medical technologists. Estimates from these sources are found in Table 10.1. Descriptions of these sources follow:

(1) Board of Registry American Society of Clinical Pathologists (ASCP). ASCP provides semiannual figures of persons fulfilling the requirements for the title MT(ASCP) to date. Data on ASCP certificants represent the number of people certified during a period of over 50 years. This is not a measure of current or active membership.

(2) Occupational Employment Statistics Survey (BLS). Data from this survey include the total number of certified and noncertified medical technologists, as well as the distribution of personnel by employment setting. Data for the hospital sector are based on the Survey of Hospital Staff, described below.

(3) Survey of Hospital Staff (NCHS-SHS). Data from this survey include the total number of certified and noncertified medical technologists employed in hospitals. Further detail from this data collection effort includes the distribution of personnel by full-time/part-time employment status.

(4) The National Clinical and Public Health Laboratory Survey (CDC-ASMT). The American Society for Medical Technology conducted the National Clinical and Public Health Laboratory Survey in 1976 under contract to the Centers for Disease Control. Results of this survey include the number of credentialed medical technologists, by certifying body, employed in laboratories.

(5) Allied Health Employment Matrix (AHEM). The AHEM estimate, which represents the full-time equivalent employment of all certified and noncertified personnel, is based on data from a sample of 17 states and the District of Columbia, which represent 44 percent of the total United States population and seven of the nine Census regions. Although there is no adjustment for nonresponse, it may be reasonable to assume that its effect is small given the large number and geographic diversity of sample states.

(6) Survey of Selected Hospital Manpower (AHA). Data from this survey represent all certified and noncertified medical technologists employed in hospitals. The distribution of personnel by

full-time/part-time employment status is provided, as is a summary full-time equivalent estimate.

(7) National Census Report (ASMT-Census). This survey, the predecessor to the National Clinical and Public Health Laboratory Survey, was conducted by the American Society for Medical Technology under contract to the Centers for Disease Control. Data from this survey include the number of certified medical technologists by certifying body.

Data Assessment: An evaluation of the estimates of the supply of medical technologists is summarized in Table 10.2. There is a high degree of comparability between the estimates of the supply of medical technologists, both for all settings and the hospital and laboratory sector.

Two estimates of employment in all settings--AHEM and BLS (which provides an unpublished preliminary estimate)--are in approximate agreement when one considers the upper limit of the AHEM estimate (85,000 FTE). The Board of Registry of the American Society of Clinical Pathologists figure does not measure a comparable population and cannot be used to estimate the number of currently employed ASCP certificants.

The estimates of medical technologists in the hospital and/or laboratory sector are also consistent. Since the BLS preliminary unpublished estimate represents laboratories and hospitals separately, it can be compared to the that of CDC-ASMT for all laboratories, whether located in hospitals or elsewhere. BLS's combined preliminary figure closely matches CDC-ASMT's count for all certified medical technologists. The correspondence between these estimates suggests that most medical technologists hold some certification. Further, the CDC-ASMT and AHA estimates, which are for the same approximate time frame, are in close agreement.

Despite the voluntary nature of the certification process for medical technologists, the definition and function of medical technologists appear to be consistent. This is an occupation for which there is general agreement as to the size of the work force.

Summary and Recommendations: The following specific recommendation for estimation of the supply of medical technologists is suggested:

> The total supply of medical technologists, and the supply by employment setting, should be estimated using the data available from the Bureau of Labor Statistics' Occupational Employment Statistics survey.

Medical Laboratory Technicians

Data Sources: Five data sources provide estimates of the supply of medical laboratory technicians. Estimates from these sources are found in Table 10.3. These data sources are:

Table 10.2. CONSISTENCY OF ESTIMATES OF ACTIVE MEDICAL TECHNOLOGISTS

Data Source	Coverage	Periodicity	Consistency of Estimate
BLS	All Medical Technologists, Total Supply and by Employment Setting	Triennial, most recently in 1978	Consistent with NCHS-SHS estimate for hospitals and CDC-ASMT estimate for hospitals and labs. Consistent with upper limit of AHEM estimate.
NCHS-SHS	All Medical Technologists Total Supply	1977	Consistent with BLS for hospitals.
CDC-ASMT	Certified Medical Technologists in Laboratories	1976	Consistent with BLS estimate for hospitals and laboratories.
AHEM	All Medical Technologists, Total Supply	1976	Upper limit of estimate is consistent with BLS.
AHA	All Medical Technologists in Hospitals	1973	Consistent with ASMT-Census estimate for all Consistent with BLS for hospitals.
ASMT-Census	Certified Medical Technologists in Laboratories	1971	Consistent with AHA estimate for hospitals.

TABLE 10.3. ESTIMATED SUPPLY OF ACTIVE MEDICAL LABORATORY TECHNICIANS BY EMPLOYMENT SETTING AND DATA SOURCE

EMPLOYMENT SETTING	DATA SOURCE				
	ASCP[1] (1980)	NCHS-SHS (1977)	CDC-ASMT[2] (1976)	AHEM[3] (1976)	ASMT-CENSUS[2] (1971)
Total	18,483			59-60,000 28-34,000 registered	
Hospitals/ Laboratories		23,700 FT 6,700 PT	9,353		2,027
All Others					

[1] Includes ever-certified MLT's(ASCP).

[2] Certified personnel only.

[3] Full time equivalent (FTE).

(1) Board of Registry of the American Society of Clinical Pathologists (ASCP). ASCP releases semiannual figures of all those qualifying for the title MLT, to date. This represents all individuals who have taken and passed the MLT exam since it was first administered in 1969.

(2) Survey of Hospital Staff (NCHS-SHS). This NCHS survey contains data on the supply of medical laboratory technicians, regardless of certification status, employed in hospitals in 1977. Further detail includes the distribution of personnel by full-time/part-time employment status.

(3) The National Clinical and Public Health Laboratory Survey (CDC-ASMT). This survey, conducted by ASMT in 1976 under contract to the Centers for Disease Control, contains estimates of certified medical laboratory technicians employed in laboratories. Estimates are broken down by certifying body.

(4) Allied Health Employment Matrix (AHEM). Data for this occupation include full-time equivalent employment of all medical laboratory technicians, as well as certified technicians, in all employment settings. Data were available from 22 states, four of which gave breakdowns by credentialing status. Fifteen states, including all those indicating credentialing status, remained after screening. These fifteen represent seven of the nine Census regions and 39 percent of the total 1976 U.S. population.

(5) National Census Report (ASMT-Census). This 1971 survey, a collaborative effort of ASMT and CDC, is an earlier version of the National Clinical and Public Health Laboratory Survey. Data include estimates, by certifying body, of the supply of certified medical laboratory technicians employed in laboratories.

Data Assessment: An evaluation of the estimates of the supply of medical laboratory technicians is found in Table 10.4. Unlike the finding for medical technologists, there is no standard definition adopted by the data sources for medical laboratory technicians. Because a large proportion of medical laboratory technicians are not certified, the sources providing estimates of certified personnel cannot be compared to those counting all personnel. In addition, there is the tendency when counting employees at the technician level to include lower-level support personnel (e.g., laboratory assistants and aides). CDC-ASMT and ASMT-Census consider only certified personnel, and restrict their populations further to those employed in the laboratory sector. AHEM provides estimates both of the total work force and those medical laboratory technicians who are credentialed; however, the estimate of credentialed personnel is based on data from only four states. NCHS-SHS estimates the total number of medical laboratory technicians, regardless of certification status, who are employed in hospitals.

The estimates appearing in Table 10.3 range from 2,027 registered medical technologists in all laboratories in 1971, to an estimated 60,000 in all settings in 1976. Clearly, these sources cannot be measuring the same population. Since the vast majority of these professionals work in

Table 10.4. CONSISTENCY OF ESTIMATES OF ACTIVE MEDICAL LABORATORY TECHNICIANS

Data Source	Coverage	Periodicity	Consistency of Estimate
NCHS-SHS	All Medical Laboratory Technicians in Hospitals	1977	Inconsistent with CDC-ASMT and ASMT-Census estimates for hospitals.
CDC-ASMT	Certified Medical Laboratory Technicians in Laboratories.	1977	Inconsistent with NCHS-SHS and ASMT-Census estimates for hospitals and laboratories.
AHEM	Total and Certified Medical Laboratory Technicians, Total Supply	1976	Inconsistent with other estimates for total supply.
ASMT-Census	Certified Medical Laboratory Technicians in Laboratories	1971	Inconsistent with NCHS-SHS and CDC-ASMT estimates for hospitals and laboratories.

hospitals and laboratories, AHEM's 1976 figure for all certified persons should approximate CDC-ASMT's estimate for the same year for certified medical laboratory technicians employed in all laboratories (including those located in hospitals). This is not, however, the case. CDC-ASMT's estimate of under 10,000 is dwarfed in comparison to AHEM's lower limit of 28,000 FTE. The CDC-ASMT and ASMT-Census estimates imply a growth of over 350 percent in five years--from approximately 2,000 in 1971 to 9,300 in 1976. Finally, the AHEM estimate of certified medical laboratory technicians is consistent with NCHS-SHS's estimate of all medical laboratory technicians, which suggests that most technicians are certified. At the same time, AHEM estimates that only about one-half of all technicians hold certification.

In summary, there are no consistent or comparable estimates of the total supply of medical laboratory technicians. In addition, no consistent estimates of medical laboratory technicians by employment setting are available.

Summary and Recommendations: The lack of a consistent definition and well defined work roles for medical laboratory technicians result in inconsistent estimates of the supply of medical laboratory technicians. Review of definitional considerations and existing data sources leads to the following recommendations:

Recommendation 1: The most important issue prohibiting the collection of reliable estimates of medical laboratory technicians is the lack of a consistent definition of the occupation. Further data collection efforts or estimation procedures will be of little use until a standard definition of the occupation is established. This could be accomplished by means of a well constructed role delineation study of the profession. The role delineation study could consist of the administration of an in-depth questionnaire mailed to a randomly selected sample of medical laboratory support personnel (e.g., technicians and assistants) employed in selected settings (e.g., hospitals, laboratories). The survey would attempt to elicit detailed information on:

- job activities;
- job responsibilities;
- job title;
- educational background;
- credential status; and
- occupational training,

in order to construct a profile of the different categories of employees working within the profession.

The survey questionnaire could be developed as a cooperative venture with participants drawn from the relevant professional associations, employer associations (e.g., AHA), educators in the field of clinical laboratory services, and federal agencies that deal with health work force issues. The results of such a study should be used to establish criteria for defining the population for which information is sought.

Recommendation 2: If a well defined occupational category can be constructed, the final recommendation would be to include the category in ongoing data collection efforts that currently provide continuous estimates for other allied health occupations such as the Bureau of Labor Statistics' Occupational Employment Statistics survey or the Census Bureau's Census of Population or Current Population Survey.

Cytotechnologists

Data Sources: Six data sources provide estimates of the supply of cytotechnologists. Estimates from these sources are found in Table 10.5. These data sources are:

(1) Board of Registry of the American Society of Clinical Pathologists (ASCP). ASCP releases semiannually updated figures of those individuals having earned the title CT(ASCP) since the first exam was given in 1957.

(2) Occupational Employment Statistics Survey (BLS). This triennial survey, produces estimates of the supply of all certified and noncertified cytotechnologists in the work force. The distribution of personnel by employment setting is also provided.

(3) Survey of Hospital Staff (NCHS-SHS). The Survey of Hospital Staff was conducted by NCHS and contains data for 1977. The estimate from this survey represents all cytotechnologists employed in hospitals, regardless of certification status. Further detail includes the distribution of personnel by full-time/part-time employment status.

(4) The National Clinical and Public Health Laboratory Survey (CDC-ASMT). This survey is a collaborative effort of ASMT and CDC. Data on cytotechnologists represent all certified personnel employed in laboratories in 1976.

(5) Survey of Selected Hospital Manpower (AHA). This 1973 AHA survey provides an estimate of all certified and noncertified cytotechnologists and cytotechnicians employed in hospitals. The distribution of personnel by full-time/part-time employment status is provided, as is a summary full-time equivalent figure.

TABLE 10.5. ESTIMATED SUPPLY OF ACTIVE CYTOTECHNOLOGISTS BY EMPLOYMENT SETTING AND DATA SOURCE[1]

	DATA SOURCE				
EMPLOYMENT SETTING	ASCP[2] (1980)	NCHS-SHS (1978)	CDC-ASMT[4] (1976)	AHA[4] (1973)	ASMT-CENSUS[3] (1971)
Total	7,192				
Hospitals/ Laboratories		2,200 FT 400 PT	4,316	2,234 (2,060.5 FTE)	2,260
All Others					

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[1] BLS estimates do not appear because they were not available for publication at the time that this report was being prepared.

[2] Includes ever-certified CT's(ASCP).

[3] Certified personnel only.

[4] Includes cytotechnologists and cytotechnicians.

(6) National Census Report (ASMT-Census). This ASMT-CDC collaborative effort produced data on the number of certified cytotechnologists employed in laboratories in 1976. Since there was only one certifying agency for cytotechnologists in 1976, only ASCP certificants are represented.

Data Assessment: An evaluation of the estimates of the supply of cytotechnologists is summarized in Table 10.6. Cytotechnology and its practitioners are defined in a consistent fashion by the data sources available. The fact that most cytotechnologists are credentialed results in consistent estimates even when definitions vary. The number of noncredentialed cytotechnologists is so small that the data sources considering only credentialed personnel are counting virtually the same population as those counting all cytotechnologists, regardless of credentials. Three sources--BLS, NCHS-SHS, and AHA--include all cytotechnologists in their estimates, whether certified or not. AHA also includes cytotechnicians, and is the only data source to do so. CDC-ASMT and ASMT-Census provide estimates of certified cytotechnologists.

Only BLS provides an estimate of cytotechnologists employed in settings other than hospitals or laboratories. It also provides the distribution of cytotechnologists by employment setting. The three estimates of hospital-employed cytotechnologists, BLS, NCHS-SHS, and AHA, exhibit a large degree of consistency. According to BLS data, this sector represents about 50 percent of total employment. There is also agreement among data sources on the combined supply of cytotechnologists in hospitals and laboratories.

In summary, cytotechnology is an occupation for which a well understood definition exists and for which continuing data are available to measure the supply of those professionals.

Summary and Recommendations: There are a number of continuously updated data sources providing estimates of the supply of cytotechnologists. Therefore, the following specific recommendation for estimation of the supply of cytotechnologists is suggested:

> The total supply of cytotechnologists, and the supply by employment setting, should be estimated using the continuous data available from the Bureau of Labor Statistics' Occupational Employment Statistics survey.

REQUIREMENTS FOR CLINICAL LABORATORY SERVICES PERSONNEL

The derivation of appropriate criteria to indicate requirements for personnel in this field included several activities: (1) interviews with knowledgeable professionals in identify factors associated with current and future requirements for clinical laboratory services; (2) evaluation of the consistency and availability of data on the supply of each profession; and (3) development of recommendations for estimating current and future requirements for these personnel.

TABLE 10.6. ESTIMATED SUPPLY OF ACTIVE CYTOTECHNOLOGISTS BY EMPLOYMENT SETTING AND DATA SOURCE[1]

	DATA SOURCE				
EMPLOYMENT SETTING	ASCP[1] (1980)	NCHS-SHS[2] (1978)	CDC-ASMT[3] (1976)	AHA[4] (1973)	ASMT-CENSUS[3] (1971)
Total	7,192				
Hospitals/ Laboratories		2,200 FT 400 PT	4,316	2,234 (2,060.5 FTE)	2,260

[1] BLS estimates do not appear because they were not available for publication at the time that this report was being prepared.

[2] Includes ever-certified CT's(ASCP).

[3] Certified personnel only.

[4] Includes cytotechnologists and cytotechnicians.

Interviews with Clinical Laboratory Services Professionals

A full description of the purpose, structure, and methodology used for this task has been provided in Chapter 2. In this section, a description of selected interviewees, a summary of results, and a discussion of implications are presented.

Description of Interviewees: In order to obtain perceptions of current issues, trends, and needs the occupational cluster encompassing clinical laboratory services, nine professionals were selected to participate in telephone interviews. These individuals represent professional associations, academic departments, are supervisors of clinical laboratory personnel, and/or are practitioners (Table 10.7.). Due to contractual constraints, a comprehensive sample of professionals representing each cross-section of the cluster was not feasible. However, association representatives and academic professionals were selected from among a tentative list of interviewees compiled with the assistance and advice of several groups within the fields. One of the academic professionals originally selected was substituted in order to obtain viewpoints on rural as well as urban market conditions. Both practitioners were randomly selected and represent geographically diverse areas.

Individuals from four professional associations were interviewed: (1) The International Society for Clinical Laboratory Technology (ISCLT); (2) American Medical Technologists (AMT); (3) American Society for Medical Technology (ASMT); and (4) American Board of Medical Microbiology.

Two medical technology professionals were selected who are heads of academic programs; one from the University of South Dakota and the other from Temple University in Philadelphia. One of the interviewees has previously taught in the field of cytotechnology and is currently teaching in the area of medical technology.

A supervisor of a large California-based hospital laboratory was chosen to participate in the interviews. This interviewee presented a slightly different outlook as the laboratory under the participant's supervision operates as a nonprofit prepaid health plan that serves a quarter of a million people. In addition, two medical technologist practitioners were interviewed; one practicing in a small hospital in California and the other working in a community hospital located in rural New York.

Results: There was general consensus among most interview participants that a shortage of clinical laboratory personnel exists. Some interview participants stated that there is inadequate staffing for evening shifts and that attracting well qualified personnel is difficult. Furthermore, it was pointed out that work in the clinical laboratory setting exists in a high stress atmosphere, and turnover is a recurring problem. The number of active clinical laboratory personnel

TABLE 10.7. MATRIX OF CHARACTERISTICS OF CLINICAL LABORATORY SERVICES CLUSTER INTERVIEWEES

	GEOGRAPHIC REGION			
CATEGORY	NORTHEAST	NORTH CENTRAL	SOUTH	WEST
Association	XX	XX		
Academic	X	X		
Employer/Supervisor				X
Practitioner	X			X

has grown substantially. These large increases reflect a change in the total number of persons and are not the result of changes in definition or credentialing requirements.

The issue of educational credentialing and the substitutability of medical laboratory professionals in the laboratory yielded substantially differing opinions among the association professionals interviewed. The interviewee at ISCLT maintained that a qualified medical technologist can adapt to work in all types of work settings. However, the existence of "artificial demarcations" set up by regulatory agencies tends to restrict the mobility of medical technologists seeking to work in different settings. Although the ISCLT is not opposed to formal academic training, their philosophy is that there should be alternative routes, other than exclusively formal academic training. Thus ISCLT encourages proficiency examinations, in lieu of an academic degree, which would allow for greater mobility. This interviewee maintained that a baccalaureate degree requirement for medical technologists frequently results in an over-trained and over-educated work force. The participant from AMT concurred that there is a growing awareness that laboratory personnel can perform as competent technicians and technologists with credentials other than the traditional academic degree. The interviewee from ASMT stated that most laboratories prefer staff with a general type of degree.

An opposing viewpoint was expressed by the participant representing the American Board of Medical Microbiologists. He said there is a hierarchy in the clinical laboratory: certified laboratory assistant, medical laboratory technician, and medical technologist. Depending upon the work setting, the distinction between the three types of professionals may get clouded. However, this *should not* occur as educational requirements for these professions are markedly different.

Factors Affecting Needs-Based Estimates. The medical needs-based approach to estimating health manpower requirements is essentially the estimation of the number of personnel needed to provide services for all health care conditions. Clinical laboratory services are not discretionary services as the consumer has little direct choice in the utilization of these services.

One relevant factor which may affect need for services, several interviewees stressed, is the development and utilization of new technologies and additional information in this field. Conflicting opinions about the merits of increased technologies and its effect on the needs of their services emerged, however. One professional suggested that increased utilization of automated technology tends to decrease the number of available jobs. An opposing view was expressed by a professional who is closely following the role of technology and who has found automation increasing the demand for medical technologists (i.e., technological advances tend to lead to new test procedures). Others noted that through automation there is an increase in the capacity to perform tests and physicians are ordering more tests not only for their own protection (i.e., malpractice considerations) but because they tend to be influenced by the scope of tests available.

Another factor that has increased the utilization of clinical laboratory services is the concept of preventive medicine. The client population is seeking out physicians willing to conduct various laboratory tests in order to detect any illness, diagnose nutritional problems, etc.

Factors Affecting Demand-Based Estimates. The demand-based approach to estimating requirements for services incorporate the individual's wants and the individual's ability to pay for goods and services.

A number of demand-based requirement factors were discussed during the interviews. Although this type of medical care is not directly demanded by the client population, reimbursement issues have had a substantial impact on the demand for clinical laboratory services, according to the participants. Insurance coverage, which reduces the cost of care to the client population, enables additional tests to be performed. Physicians, in turn, are less hesitant in requesting additional laboratory tests.

Federal legislation such as Medicare and Medicaid has had an impact of professional services. For example, in order for facilities to comply with regulations, they must employ personnel who qualify to perform clinical laboratory services. Thereby resulting in increased demand for those who fulfill the requirements for qualification.

Economics may also affect the demand for clinical laboratory services as the cost-containment policies of hospitals and government may prevent the hiring of additional laboratory personnel.

Other Considerations. Some individuals suggested that there should be a shift in the focus of educational requirements. For example, increased use of automation in the laboratory has eliminated some of the tedious manual techniques but has also necessitated increased skills in other areas, such as the application of computer skills. It is expected that shifts toward employment of more highly educated and/or specialized practitioners may occur in the future.

Another factor noted by some participants is the maldistribution of available personnel. As several interviewees pointed out, employment opportunities are readily available in rural areas and in the Midwest. However, there is a tendency for graduates of training programs to prefer to remain in the urban areas where they trained.

Considerable concern was voiced about continuing competency. Most of the interviewees implied the need for credentialing procedures as some form of quality control. A few maintained that neither examinations nor continuing education programs provide the definitive answer in measuring competence.

Summary: Major points and factors affecting needs-based and demand-based estimates for clinical laboratory personnel are summarized in Table 10.8. Overall, the professionals interviewed shared the belief that there is a shortage of personnel in laboratory services and were optimistic about the future growth of this allied health profession.

Through the interviews it became apparent that research needs to be conducted to examine the functions of and relationships among the three disciplines in this cluster. Examination of these issues in relation to specialization of laboratory services and corresponding types of personnel needed would be useful.

If there is movement to impose credentialing standards on a national basis, then the demand for certified professionals will increase substantially. However, credentialing procedures must be studied concurrently with such variables as declining enrollment in initial training programs and decline in the traditional female participation in this field.

Although the interviews with the nine professionals yielded new information on the factors that influence the need and demand for clinical laboratory services, a comprehensive listing of variables was not sought. Several trends are evident in this field and the individuals participating in this research effort were cognizant of the need to meet these changes. Further research should be conducted to supplement the analytical foundation of this study in order to determine better estimates of work force requirements in this field.

Estimating Current Requirements for Medical Technologists

The general recommendation proposed in Chapter 2 of this report is that a personnel-to-population ratio approach be used to establish current requirements estimates. The examination of definitional considerations and of data availability suggest that this is a feasible recommendation for this occupation. As a result, the following specific recommendations for estimation of current requirements for medical technologists are suggested:

Recommendation 1(a): If a decision is made to define medical technology as limited to practice by those holding certification, then it is recommended that a medical technologist-to-population ratio be constructed using available data on certified personnel.

Recommendation 1(b): If a decision is made to include within medical technology all certified and noncertified personnel, then it is recommended that a medical technologist-to-population ratio be constructed using BLS data for the numerator of the ratio1.

Recommendation 2: Determination of a standard of adequacy for the medical technologist-to-population ratio should be made. A national mean or a state median value may be appropriate, to the extent data can be obtained. Since use of a national average would incorporate existing shortages into the requirements estimate, it is recommended that determination of the standard of adequacy take into account any existing evidence on the presence of a current shortage (e.g., number of job vacancies, increase in salary levels).

Recommendation 3: Use of the medical technologist-to-population ratio standard of adequacy to assess whether subnational geographic regions have sufficient technologists to meet existing requirements should take into account characteristics of the subnational region in determining whether an excess or shortage of medical technologists exists. Specifically, consideration should be given to the employment settings in which medical technologists may be employed (e.g., hospitals, private laboratories) and state licensure requirements.

Estimating Future Requirements for Medical Technologists

The medical technologist-to-population ratio and the standard of adequacy selected to estimate current requirements for medical technologists will provide basis for estimation of future requirements for this professional group.

One alternative approach to estimating future requirements is to assume that the medical technologist-to-population ratio standard of adequacy represents the minimum level of future requirements. Therefore, projected increases in the population require that proportional increases in the numerator of the ratio occur. This approach has the advantage of simplicity but fails to take into account factors other than population growth which may be expected to affect requirements for medical technologists in the future.

Interviews with individuals knowledgeable of the medical technology field focused, to a great extent, on factors which are expected to affect requirements for medical technologists in the future. A summary of the more relevant of the findings from these interviews has been provided in Table 10.8. Review of this information has resulted in the development of the following recommendations for determining future requirements for medical technologists.

Recommendation 4: The standard of adequacy of the certified medical technologist-to-population ratio selected for the estimation of current requirements should be used as the foundation for the development of estimates of future requirements for medical technologists. Projections of future population size from the U.S. Bureau of the Census can be used to establish the denominator of the future ratio and the numerator (i.e., required number of medical technologists to provide a constant level of services to the future population) can be constructed.

Recommendation 5: Refinement of the estimate of future requirements for medical technologists should take into account the factors indicated in Table 10.8, to the extent possible. While the direction of the effects of such factors on requirements may be clear, the magnitude of the impact has not been determined. Consequently, it is recommended that professional opinions be sought prior to attempting to refine the ratio to permit adjusted future requirements to be calculated.

TABLE 10.8. SUMMARY OF FINDINGS FROM INTERVIEWS WITH CLINICAL LABORATORY PROFESSIONALS

ISSUE		FINDINGS
Overview	o	There appears to be a shorage of professionals in this field.
	o	Ensuring appropriate standards and educational requirements for practitioners is a major concern.
Need Factors	o	Technological innovations are expanding and changing the role of the clinical laboratory professionals.
	o	Preventive medicine has increased the need for services.
Demand Factors	o	Reimbursement for services has increased the demand for additional laboratory services.
	o	Cost-containment policies may play a vital role as hospitals may not permit vacancies to be filled.
Other Factors	o	Maldistribution of qualified services exists, especially in rural areas and in smaller community facilities.

TABLE 10.8 : (Continued)

Other Factors	o A shift in emphasis toward more complex skills and more analytical judgements suggests a growth in requirements for more highly trained personnel.

Various factors, including population change (i.e., aging) are important in determining future requirements which is directly a function of the time interval over which future requirements are to be estimated. In addition, the importance of expert opinion input to the future requirements may be a crucial factor. In all, it is clear that estimate of future requirements demands that judgemental decisions be made.

Estimating Current and Future Requirements for Medical Laboratory Technicians

Review of definitional considerations and existing data sources lead to the following recommendation:

> It is recommended that no separate estimate of current or future requirements for medical laboratory technicians be prepared. Instead, it is recommended that total requirements for the profession included in the clinical laboratory services cluster should be estimated. Requirements for medical laboratory technicians may then be derived from the cluster estimates of total current and future requirements by subtracting from the cluster estimate the separate estimates for cytotechnologists and medical laboratory technologists.

If in the future, appropriate data sources become available to permit direct separate estimation of requirements for medical laboratory technicians, this estimation may then be performed.

Estimating Current Requirements for Cytotechnologists

The following recommendations are made, paralleling the recommendation for medical laboratory technologists, based on review of definitional considerations and existing data sources:

> Recommendation 1: Cytotechnologists-to-population ratios should be constructed using data from BLS, after the definition of cytotechnologist to be used has been selected.

Recommendation 2: Determination of a standard of adequacy for cytotechnologist-to-population ratio should be made. A national mean or a state median value may be selected, to the extent that data are available. Since use of a national average would incorporate existing shortages into the requirements estimate, it is recommended that determination of the standard of adequacy take into account any existing evidence on the presence of a current shortage (e.g., number of job vacancies, rate of increase in salary levels).

Recommendation 3: Use of the cytotechnologist-to-population ratio standard of adequacy to assess whether subnational geographic regions have sufficient cytotechnologists to meet existing requirements should take into account characteristics of the subnational region in determining whether an excess or shortage of cytotechnologists exists. Specifically, consideration should be given to the employment settings in which cytotechnologists may be employed (e.g., hospitals).

Estimating Future Requirements For Cytotechnologists

The recommendations for estimation of future requirements for cytotechnologists parallel those recommendations for medical laboratory technologists:

Recommendation 4: The standard of adequacy of the cytotechnologist-to-population ratio selected for the estimation of current requirements should be used as the foundation for the development of estimates of future requirements for cytotechnologists. Projections of future population size from the U.S. Bureau of the Census can be used to establish the denominator of the future ratio and the numerator (i.e., required number of cytotechnologists to provide a constant level of services to the future population) can then be constructed.

Recommendation 5: Refinement of the estimate of future requirements for cytotechnologists should take into account the factors indicated in Table 10.8, to the extent possible. While the direction of effects of such factors on requirements may be clear, the magnitude of the impact has not been determined. Consequently, it is recommended that professional opinions be sought prior to attempting to refine the ratio to permit adjusted future requirements to be calculated.

Combined Clinical Laboratory Services Estimates

Relatively consistent data are available to permit separate estimates of requirements for medical laboratory technologists and cytotechnologists. However, this in not the case for the medical laboratory technician profession. Consequently, it was recommended that estimates of total requirements for personnel to provide clinical laboratory services be prepared. The separate estimates for medical laboratory technicians may then be derived from this total estimate.

The following recommendations are presented which may be implemented if estimation of current and future requirements for total clinical laboratory personnel are desired:

Recommendation 1: State-level clinical laboratory personnel-to-population ratios should be constructed. Data from the Census are the best data source for this purpose as they are both consistent and most recent.

Recommendation 2: Determination of a standard of adequacy for the clinical laboratory personnel-to-population ratio should be made. A national mean or a state median value may be appropriate, to the extent data can be obtained. Since use of a national average would incorporate existing shortages into requirements estimate, it is recommended that determination of the standard adequacy take into account any existing evidence on the presence of a current shortage (e.g., number of job vacancies, increase in salary levels).

Recommendation 3: Use of the clinical laboratory personnel-to-population ratio standard of adequacy to assess whether subnational geographic regions have sufficient clinical laboratory personnel to meet existing requirements should take into account characteristics of the subnational region in determining whether an excess or shortage of clinical laboratory personnel exists. Specifically, consideration should be given to the employment settings in which clinical laboratory personnel may be employed (e.g., hospitals, private laboratories) and state licensure requirements.

Recommendation 4: The standard of adequacy of the clinical laboratory personnel-to-population ratio selected for the estimation of current requirements should be used as the foundation for the development of estimates of future requirements for clinical laboratory personnel. Projections of future population size from the U.S. Bureau of the Census can be used to establish the denominator of the future ratio and the numerator (i.e., required number of clinical laboratory personnel to provide a constant level of services to the future population) can be constructed.

Recommendation 5: Refinement of the estimate of future requirements for clinical laboratory personnel should take into account the factors indicated in Table 10.8. to the extent possible. While the direction of the effects of such factors on requirements may be clear, the magnitude of the impacts have not been determined. Consequently, it is recommended that professional opinions be sought prior to attempting to refine the ratio to permit adjusted future requirements to be calculated.

Recommendation 6: These total cluster-level estimates may be used to derive an estimate of current and future requirements for medical laboratory technicians. It is recommended, however, that professional opinion be sought to determine what fraction of the total cluster may be expected to be medical laboratory technicians. This is a relatively important step since there may be other occupations being counted in the data sources available at the cluster level.

The estimates of requirements at the cluster-level may be useful in assessing overall requirements for clinical laboratory services. In addition, some rough estimates of requirements for medical laboratory technicians may be derived from these data. If, in the future, a clear definition and reliable data become available to permit separate estimation of requirements for medical laboratory technicians, these estimates should be undertaken, if possible.

Chapter 11
Medical Record Services

OVERVIEW OF THE PROFESSION

The field of medical records is composed of two occupations: (1) *medical record administrators*; and (2) *medical record technicians*. The functions of these two professions relate to the development, management and evaluation of a system that provides for the acquisition, processing, use, evaluation and retention of medical records of patients in a variety of (primarily) institutional settings. The purposes and uses of medical records have been described as:

> A medical record is the permanent record of the history and treatment of one person's illness or injury, incorporating and preserving information of medical, scientific, legal, and planning value. A compilation of observations and findings recorded by the patient's physician and other members of the health care team, it includes items such as provisional and final diagnoses, X-ray and laboratory reports, cardiogram tracings, pulmonary function tests, and drugs prescribed.
>
> While accurate history-taking and record-keeping is obviously vital to diagnosis and treatment of the individual, these records also provide critically important information to health care providers, researchers, public health agencies, accrediting and licensing bodies, and medical reimbursement organizations. Medical records provide the factual data upon which hospital planning decisions are made and upon which hospital accreditation and licensure decisions are made. They enable health care facilities and staff members to document the adequacy of their services to patients and to investigate cases in which such responsibilities may not have been adequately discharged. Medical record data permit evaluation of new methods of treatment and the comparative effectiveness of different medications, as well as enabling medical, epidemiological, and public health researchers to study the cause, control, and prevention of certain types of disease within population groups of varying sizes. Such records are required, as well, to permit authentication of legal forms and insurance claims for third party reimbursement organizations.[1]

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[1] U.S. DHEW, *A Report on Allied Health Personnel*, DHEW Publication No. HRA 80-28, November 1979, p. IX-1.

While the most common employment setting for medical record personnel is the hospital, there is a substantial number of these professionals employed in other settings. These secondary employment settings include nursing homes, health maintenance organizations, outpatient and ambulatory care centers, insurance companies, professional standards review organizations, and private industry, among others. Medical record technicians are employed in the same settings as are medical record administrators with some minor differences in distributional patterns.

Medical Record Administrators

The specific functions of medical record administrators have been described as:

> Medical record administrators plan, develop and administer medical record systems for public, private, and military health care facilities. They collect and analyze patient and institutional data, as well as creating and implementing policies and procedures for the collection, storage, retrieval, and release of data for medical, administrative, legal, and research purposes.[2/]

Credentialing of medical record administrators is voluntary, and is offered through the American Medical Record Association (AMRA). To be eligible for the national examination, candidates must have received either a baccalaureate degree in medical record science from an accredited institution or a certificate of completion from an approved one-year post-baccalaureate program in medical records.

Although not a requirement for job entry, the basic occupational preparation of medical record administrators consists of graduation from an accredited program at the baccaluareate level. One-year certificate programs are also available to individuals who have received a baccalaureate degree in another discipline.

Medical Record Technicians

A medical record technician may qualify to take AMRA's Accredited Record Technician (ART) national examination by completing an associate degree program in medical record science at an accredited institution or by completing the requirements for the AMRA-sponsored accredited correspondence course. The specific functions of the ART have been described as follows:

[2/] *Ibid.* p. 1X-2.

Medical record technicians provide assistance to medical record administrators by performing many essential technical activities in the medical record department of a health care institution or agency. Their duties are varied and dependent on the size of the facility in which they work. In a small facility they are likely to work independently with only occasional consultation with a medical record administrator. In some cases they may be employed as directors of medical record departments.

In general, medical record technicians compile and maintain medical records and review them for completeness and accuracy. They code symptoms, diseases, operations, procedures, and other therapies according to standard classification systems and post codes on medical records to facilitate information retrieval.

Technicians maintain and use a variety of health record indexes and compile medical care and census data for public health and other statistical reports. They assist the medical staff by tabulating data from records for research purposes and for use in evaluating and planning health care services programs.

Other responsibilities include transcription, directing the routine operation of a medical record department, and either filing or directing filing by medical record clerks. [3]

DEFINITIONAL CONSIDERATIONS

Prior to determining the existing supply or estimating requirements for services provided by medical records personnel, it is essential that a consistent definition of each occupation be selected. However, the occupational cluster represented here presents special problems in regard to definitions.

Medical Record Administrators

The available data sources indicate a lack of agreement as to the population of medical record administrators to be estimated. Thus, prior to estimating the supply of medical record administrators, it will be necessary to select a definition of the population of medical record administrators. Two alternatives are apparent:

(1) "Medical record administrators" may be defined as those who have completed all requirements for AMRA registration; or

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[3] *Ibid*, p. 1X-3.

(2) "Medical record administrators" may be defined as the total supply of persons employed as medical record administrators, irrespective of registration status.

For this occupation, the difference between the two definitions in estimating the supply of personnel may be as much as 60 percent. Consequently, in order to estimate the supply of medical record administrators, a choice must be made between these two alternative definitions.

Medical Record Technicians

There is no consistent definition of the population of medical record technicians among available data sources. As will be demonstrated below, the five data sources for medical record technicians provide no basis upon which to estimate the supply of the work force for the occupation.

As was discussed above for medical record administrators, the primary definitional issue for this cluster is accreditation status of practitioners. A very small fraction of the population seems to hold the credential Accredited Record Technician, based on comparisons of many estimates. It is possible, however, that some estimates of the total supply of medical record technicians, regardless of certification, include file clerks, transcriptionists, and other support personnel.

Given these considerations, it is clear that definition of this occupation is a necessary first step prior to estimation of requirements for medical record technicians. Two alternative definitions are suggested:

(1) "Medical record technicians" may be defined as those who are employed and who are Accredited Record Technicians by AMRA's standards; and

(2) "Medical record technicians" may be defined as those persons who perform specified functions (described in the section above) in a medical record department.

If the latter definition is adopted, it will be important to refine the definition to ensure that technician-level personnel can be clearly separable from lesser-trained staff such as transcriptionists, coders, etc., to estimate the supply of medical record technicians.

SUPPLY OF MEDICAL RECORDS SERVICES PERSONNEL

Data sources providing information on the supply of medical records professionals have been reviewed. Results and recommendations are discussed separately for medical record administrators and for medical record technicians.

Medical Record Administrators

Data Sources: Five sources of data provide estimates of the supply of medical record administrators. The estimates from these data sources may be found in Table 11.1. These data sources are:

(1) American Medical Record Association (AMRA). The American Medical Record Association releases monthly figures of active registered medical record administrators. Thus, the target population consists of all individuals who have fulfilled the requirements for an RRA.

(2) Survey of Hospital Staff (NCHS-SHS). Estimates provided for this occupation represent the total number of registered and nonregistered medical record administrators employed in hospitals. Further detail provided by this survey includes the number of full-time and part-time employees.

(3) National Nursing Home Survey (NCHS-NNHS). The target population for this survey is all registered medical record administrators employed in nursing homes. The distribution of employees by full-time/part-time employment status is also available. A concerted effort was made to identify those persons working on a contractual basis. The result of this is that persons working part-time on a contractual basis in more than one nursing home may be double counted.

(4) Allied Health Employment Matrix (AHEM). AHEM first produced an estimate of all medical record administrators and, based on this, also estimated the supply of registered record administrators. Twenty-five states made data available to AHEM on medical record administrators. Only two did not pass the screening process. The remaining states represent over half of the U.S. population, and at least one state from each of the nine Census regions is included in the sample. AHEM extrapolated the sample data to full-time equivalent (FTE) employees in all settings in the United States for 1976. AHEM's estimate for registered personnel is based on the ratio of registered to total medical record administrators in one state--New Jersey--which was extrapolated to include all registered administrators in the U.S. While the AHEM methodology is applicable to any time frame, the project is not currently scheduled to be repeated.

(5) Survey of Selected Hospital Manpower (AHA). Data from this survey include an estimate of the supply of all registered and nonregistered record administrators employed in hospitals. Further detail includes the distribution of employees by full-time/part-time employment status.

Data Assessment: A summary of the consistency of the estimates for this occupation may be found in Table 11.2. There are no reliable estimates currently available to assess the size of the work force of

TABLE 11.1: ESTIMATED SUPPLY OF ACTIVE MEDICAL RECORD ADMINISTRATORS BY EMPLOYMENT SETTING AND DATA SOURCE

EMPLOYMENT SETTING	DATA SOURCE				
	AMRA 1/ (1978)	NCHS-NNHS 2/ (1977)	NCHS-SHS (1977)	AHEM 3/ (1976)	AHA (1973)
Total	6,500			8,600-9,000 5,280-5,500 RRA	
Hospitals			5,500 FT 500 PT		5,267 (4,960.0 FTE)
Nursing Homes		600 FT 4,400 PT			

1/ Includes registered personnel only.

2/ Includes registered personnel only. Nonregistered administrators are included in the category of medical record technicians.

3/ Full time equivalent (FTE).

Table 11.2. CONSISTENCY OF ESTIMATES OF ACTIVE MEDICAL RECORD ADMINISTRATORS

Data Source	Coverage	Periodicity	Consistency of Estimate
AMRA	Registered Record Administrators, Total Supply	Monthly, most recently in 1978	Consistent with AHEM estimate for registered personnel.
NCHS-SHS	Registered and Nonregistered Record Administrators in Hospitals	1977	Roughly consistent with AHA for hospitals.
NCHS-NNHS	Registered Record Administrators in Nursing Homes	1977	Unassessable due to unique coverage.
AHEM	Registered and Total Record Administrators, Total Supply	1976	Consistent with AMRA for registered personnel. Estimate for total personnel is unassessable due to unique coverage.
AHA	Registered and Nonregistered Record Administrators in Hospitals	1973	Roughly consistent with NCHS-SHS for hospitals.

registered and nonregistered medical record administrators employed in all settings. Because only one source, AHEM, attempts to measure the total population, there is no basis upon which to judge the accuracy of the resulting estimate.

The AHEM estimate of the number of registered administrators, however, can be compared with the AMRA estimate of the number of RRAs employed in all settings. The AHEM and AMRA estimates of registered personnel are very close when AMRA data are converted to FTE employment. These sources indicate that there were between 5,500 and 5,700 FTE employed RRAs during the 1976 to 1978 period. However, both sources provide only limited information on the size of the profession since they lack an appropriate methodology with which to assess medical record administrators who have no affiliation with the association.

In the hospital sector, the AHA and NCHS-SHS estimates are in approximate agreement. Both estimate between 5,000 and 5,500 registered and nonregistered administrators employed in hospitals. Data from earlier hospital surveys (1966 and 1969) actually show a slight decrease in employment for this occupation over time.

Only one source, NCHS-NNHS, provides data on employment in nursing homes.
Therefore, evaluation of the validity of the NCHS-NNHS estimate is not possible.

In summary, the review of data sources on the supply of medical record administrators leads to the following conclusions:

(1) there appear to be adequate and appropriate data available on a continuous basis for the supply of RRAs in all employment settings;

(2) there are currently no reliable data sources on the total supply of registered and nonregistered record administrators in all employment settings; and

(3) there are comparable estimates of the total supply of registered and nonregistered medical record administrators in hospital settings, but not in other settings.

Summary and Recommendations: Medical record administrators constitute an occupation for which alternative definitions exist, and for which the quality of available data varies with the definition used. Consequently, the following specific recommendations for the estimation of the supply of medical record administrators are suggested:

Recommendation 1: The supply of Registered Record Administrators should be estimated using the continuous, reliable data available from the American Medical Record Association.

Recommendation 2(a): For the total supply of medical record administrators, registered and nonregistered, it is recommended that an attempt be made to have the Bureau of Labor Statistics or the Bureau of the Census include the category, medical record administrators, in their ongoing data collection efforts. Both sources currently provide continuous, reliable estimates for a number of the allied health occupations under investigation. However, neither source currently collects data on the supply of medical record administrators. Instead, the sources collect information at the cluster level for the supply of medical record technologists and technicians.

Recommendation 2(b): A second, more costly, approach to estimating the supply of registered and nonregistered medical record administrators would be to collect information on a random sample of medical record administrators to determine the ratio of registered to nonregistered personnel in the sample. Since the number of registered record administrators is known, the ratio obtained from the sample survey could be used to extrapolate the total supply of medical record administrators.

The sample size required to estimate this ratio is not very large. For a confidence level of 95 percent, a sample of approximately 375 medical record administrators drawn at random will provide an estimate of the registered:nonregistered ratio with assurance of a sampling error not exceeding five percent. To reduce the sampling error to three percent, a sample of approximately 975 medical record administrators would be required.

Sample selection procedures can be targeted to a specific employment setting. Estimates of the distribution of medical record administrators by employment setting indicate that as many as 80 percent of all administrators are employed in hospitals. Hence, little precision will be lost if sample selection procedures are focused on the hospital sector. A listing of all hospitals in the U.S., from which a random sample could be drawn, is available from the American Hospital Association which maintains a data file on member hospitals (95 percent of the total), and the National Center for Health Statistics' Master Facility Inventory which collects information on non-AHA hospitals (about five percent of all hospitals in this country).

Recommendation 2(c): A third approach to estimating the supply of registered and nonregistered personnel is an indirect approach based on information on the annual number of graduates of accredited schools of medical record science or approved one-year post-baccalaureate programs in medical records. This approach has been used successfully for occupational therapists; however, there are extensive data requirements associated with this approach. To the extent that these data requirements cannot be fulfilled, the effectiveness of this approach for the occupation of medical record administrators will be limited.

Information is required on the age and sex distribution of graduates from accredited medical record programs, and on the labor force participation rates of medical record administrators for different age and sex categories (e.g., males ages 30-35). Information on mortality rates for the various age and sex categories is also required. Unfortunately, much of the needed information is currently unavailable for medical record administrators. Special surveys would be required to estimate some of the key parameters underlying this approach. In addition, there is little information on the extent to which individuals who have not graduated from accredited schools may be employed as medical record administrators. Hence, this approach is currently not feasible for estimating the supply of registered and nonregistered personnel. However, it is an approach that should continue to be explored and eventually implemented if the data requirements can be met at some time in the future.

Medical Record Technicians

Data Sources: The five sources that provide estimates of the supply of medical record administrators also estimate the supply of medical record technicians. Estimates from these sources may be found in Table 11.3.

(1) American Medical Record Association (AMRA). AMRA releases monthly figures on the number of accredited record technicians. Thus, the estimate reported is limited to those qualifying as ARTs.

(2) Survey of Hospital Staff (NCHS-SHS). Estimates from this survey, described above for medical record administrators, represent the total number of accredited and nonaccredited record technicians as well as nonregistered medical record administrators employed in hospitals. Further detail includes the distribution of personnel by full-time/part-time status.

(3) National Nursing Home Survey (NCHS-NNHS). NCHS-NNHS contains data on the total number of accredited and nonaccredited medical record technicians employed in nursing homes in 1977. Results of the survey include the number of full-time and part-time employees. Again, it is likely that part-time employees working on a contractual basis in more than one nursing home are double counted.

TABLE 11.3: ESTIMATED SUPPLY OF ACTIVE MEDICAL RECORD TECHNICIANS BY EMPLOYMENT SETTING AND DATA SOURCE

	DATA SOURCE				
EMPLOYMENT SETTING	AMRA 1/ (1978)	NCHS-NNHS 2/ (1977)	NCHS-SHS (1977)	AHEM 3/ (1976)	AHA (1973)
Total	12,500			12,900-18,100	
Hospitals		21,300 FT 3,100 PT			14,565 (13,437.0 FTE)
Nursing Homes	2,700 FT 1,400 PT				
All Others					

1/ Includes registered personnel only.

2/ Includes both technicians and nonregistered administrators.

3/ Full time equivalent (FTE).

(4) Allied Health Employment Matrix (AHEM). AHEM's estimate for this occupation represents the 1976 full-time equivalent supply of accredited record technicians; however, unlike AHEM's estimating procedure for medical record administrators, no attempt was made by AHEM to extrapolate the number of ARTs to the total number of employed medical record technicians.

AHEM collected data from 18 states for this occupation; data from 13 states remained after screening. Of these, eight specified that only accredited medical record technicians were included in the state counts and five states were unclear about the definition used. Hence, the AHEM estimate of ARTs may include some nonaccredited personnel. These 13 states represent 35 percent of the total 1976 United States population. Eight of the nine Census regions are represented.

(5) Survey of Selected Hospital Manpower (AHA). Data from this survey include the total number of accredited and nonaccredited medical record technicians employed in hospitals in 1973. Resulting estimates are broken down by full-time/part-time employment status, and a summary full-time equivalent figure is provided.

Data Assessment: A summary of the consistency of the estimates may be found in Table 11.4. The five different data sources use almost as many different definitions of medical record technicians. NCHS-SHS and AHA both count all medical record technicians while AMRA and AHEM estimate only accredited personnel. NCHS-NNHS considers all technicians; however, they add to this figure nonregistered medical record administrators.

Both AMRA and AHEM estimate the number of accredited record technicians (ARTs); however, unlike AHEM's estimating procedure for medical record administrators, no attempt was made by AHEM to extrapolate the number of ARTs to the total number of employed medical record technicians. Once again, NCHS-NNHS covers a unique population including in its effort, not only all medical record technicians in the nursing home sector, regardless of accreditation status, but also nonregistered medical record administrators. Thus, the consistency of this estimate cannot be assessed. Both NCHS-SHS and AHA report the number of medical record technicians in the hospital sector, regardless of accreditation status.

There is no agreement among the data sources on the supply of medical record technicians, regardless of accreditation status, employment sector, or time frame. AHEM which concedes that its estimate of ARTs may include some nonaccredited personnel also reports a substantially higher figure than does AMRA for ARTs in all employment settings. This difference is exaggerated by the fact that the AHEM estimate is for 1976, which should be less than AMRA's estimate for 1978, given that there has been growth in the occupation.

Table 11.4. CONSISTENCY OF ESTIMATES OF ACTIVE MEDICAL RECORD TECHNICIANS

Data Source	Coverage	Periodicity	Consistency of Estimate
AMRA	Accredited Record Technicians, Total Supply	Monthly, most recently in 1978	Inconsistent with AHEM estimate.
NCHS-SHS	Accredited and Nonaccredited Record Technicians in Hospitals	1977	Inconsistent with AHA for hospitals.
NCHS-NNHS	Accredited Record Technicians, Nonregistered Record Administrators and Technicians in Nursing Homes	1977	Unassessable due to unique coverage.
AHEM	Accredited Record Technicians, Total Supply	1976	Inconsistent with AMRA estimate.
AHA	Accredited and Nonaccredited Record Technicians in Hospitals	1973	Inconsistent with NCHS-SHS for hospitals.

In summary, among available data sources, there is no consistent definition of population, agreement on employment setting, or period of data collection. As a result, the five data sources for medical record technicians provide no basis upon which to estimate the supply of the work force for the occupation.

Summary and Recommendations: Although AMRA has established standards for the certification of medical record technicians, there is no substantive agreement among existing data sources on the functions and/or qualifications needed to define the population for survey purposes. The following recommendations would permit improved estimates of supply to be developed.

Recommendation 1(a): The total supply of accredited medical record technicians, if desired, may be estimated using AMRA data currently available.

Recommendation 1(b): An estimate of the total supply of medical record technicians, regardless of credentials, requires a standard definition of the population.

This could be accomplished by means of a well constructed role delineation study of the profession. The role delineation study could consist of the administration of an in-depth questionnaire mailed to a randomly selected sample of medical record administrators and support personnel (e.g., technicians, aides, and assistants) employed in selected settings (e.g., hospitals, nursing homes). This survey would attempt to elicit detailed information on:

- job activities
- job responsibilities
- job title
- educational background
- credential status
- occupational training

in order to construct a profile of the different categories of employees working within the profession.

The American Medical Record Association has recently completed a Membership Profile survey in which data were collected for a number of the variables listed above. One drawback to this study is that nonmember medical record personnel were not included in the investigation; however, the results of this study should be monitored closely, and may potentially be used to establish criteria for defining the population for which information is sought (i.e., medical record technicians).

Recommendation 2: If a well defined occupational category can be constructed, the final step would be to include the category in ongoing data collection efforts that currently provide continuous, reliable estimates for other allied health occupations such as the Bureau of Labor Statistics' Occupational Employment Statistics survey or the Census Bureau's Census of Population or Current Population Survey.

REQUIREMENTS FOR MEDICAL RECORDS PERSONNEL

The derivation of appropriate criteria to indicate requirements for medical records administrators and medical records technicians was conducted as follows: (1) interviews with knowledgeable professionals to identify factors associated with current and future requirements for medical records services; (2) evaluation of the consistency and availability of data on the supply of each profession; (3) development of recommendations for estimating current and future requirements in this field; and (4) construction of personnel-to-population ratios for each profession, using the most reliable data available.

Interviews With Medical Records Professionals

A full description of the purpose, structure, and methodology used for the interviews was provided in Chapter 2. In this section, a description of the selected interviewees, a summary of results, and a discussion of implications are presented.

Description of the Interviewees: Within the limited number of interviews to be conducted for this phase of this project, an effort has been made to maximize the likelihood of obtaining diverse viewpoints and perceptions.

Among the nine interviewees, three are permanent staff of the American Medical Record Association which is based in Chicago, Illinois. However, there is considerable overlap among the categories to which these individuals may be assigned (i.e. association, academic, employer/supervisor and practitioner). Of the three professional association staff persons, all three are RRAs. One has been with AMRA only one year and, previously, was director of medical records and quality assurance for a large hospital where she had been employed for nine years. A second association person interviewed has a substantial background in education and educational issues for medical record practice. The third person from AMRA has been with AMRA for several years after having previously practiced for a number of years as a medical record administrator. Each brings the perspective of a supervisor, practitioner, or educator to the interview, in addition to his or her knowledge of the major national issues affecting the profession.

Two persons with primarily academic backgrounds were selected to be interviewed. One is director of a medical record administration program at a university in the eastern U.S. The other academic person selected is director of a program, which has been in existence for over 30 years, at a private university in the West.

One medical record professional who is an employer of medical record personnel was interviewed. This individual is currently in charge of a medical record staff for the Veteran's Administration. In addition, she has a wide range of experience as a practitioner and supervisor in other hospital settings.

Three practitioners were randomly selected to be interviewed. One is an ART who is in charge of a medical record department in a small rural hospital. Another individual is an RRA who is assistant to another RRA who is director of a medical record department of a hospital in a small urban area. The third interviewee in this category is an ART who is employed in a 167-bed hospital which has an RRA as director of the medical record department.

Overall, an attempt has been made to achieve geographic representation, among the nine interviewees selected. Depiction of the categorical and geographic distribution of the interviewees is presented in Table 11.5. To the extent possible, the nine interviewees represent a diverse group from whom a wide range of information and opinions have been elicited.

Results: No clear consensus emerged from these interviews on the issue of whether the current supply of medical record professionals constitutes an adequate or an inadequate national supply. Answers to this question ranged from indications that a current shortage exists--to a response that there was a shortage of RRAs, but not ARTs--to two responses that the market was not currently as good as it had been in the past for medical record professionals. However, most interviewees were in agreement that the future for medical record professionals is bright and that they expect requirements to increase in the next few years. This view was supported by the fact that new educational programs for both RRAs and ARTs have been opening at a fairly rapid pace.

Table 11.5: MATRIX OF CHARACTERISTICS OF MEDICAL RECORD PERSONNNEL INTERVIEWEES

	GEOGRAPHIC REGION			
CATEGORY	NORTHEAST	NORTH CENTRAL	SOUTH	WEST
Association		XXX		
Academic	X			X
Employer	X			
Practitioner	X		X	X

The individuals interviewed were also in agreement on what credentials and education were necessary for a person to be a medical record professional. Two of the interviewees (both from AMRA) expressed substantial objections to the conclusions reached and data used to examine the profession in the Report to Congress on Allied Health Personnel. They stated that the total supply figures presented grossly misrepresent the actual situation and that these data, apparently, are a result of the inclusion of file clerks, transcriptionists, and other support personnel as medical record personnel. Remedying the misconceptions created by this inaccurate presentation was perceived to be a major issue.

Factors Affecting Needs-Based Estimates. Two major themes emerged from the interviews which indicate that needs for medical record based services may change.

1) The profession provides support services to the health care delivery system. Consequently, anything which affects needs for health services will also affect needs for medical record personnel. Health-care related factors mentioned were:

    - increasing proportion of the population which is elderly and requires more health services per capita; and

    - increasing preventive care emphasis in medical care.

2) The current rapid expansion of computerization of records and development of sophisticated technologies of information systems will require well-trained professionals to design, implement, and maintain such systems.

Two of the participants mentioned that there have been no extensive efforts made to estimate needs for medical record services or to evaluate the benefits to be derived from utilization of appropriately trained personnel and the mix of skills and services needed. The lack of research in this area makes it difficult to array evidence on the current or future adequacy of the medical record personnel supply.

Factors Affecting Demand-Based Estimates. There was general agreement among the interviewees that demand for medical record personnel was strongly affected by legislation and by government regulation. One interviewee said that in 90 percent of short-term acute hospitals there is at least one certified medical record professional. This near-universal employment in hospitals is, primarily, a result of Federal regulations. On the other hand, regulations affecting nursing home participation have, in the past, required only that a professional medical record consultant be retained. Proposed regulations currently under consideration would require only that the nursing home employ credentialed or "equivalent" personnel. If these regulations are approved, demand for RRAs as consultants to nursing homes may decline. Other legislative or regulatory factors which may influence demand for medical record professionals include:

- privacy and confidentiality of records issues;
- patient access to medical records rights;
- OSHA and industrial health requirements; and
- PSRO and utilization review data requirements.

A primary factor which will affect future demand for medical record professionals is the need for adequate and high quality data for reimbursement from third party payers. One interviewee mentioned that there have been studies of accuracy of medical record data which indicated a high error rate in such critical information as diagnosis. Since reimbursement and/or the level of reimbursement may depend upon the accuracy of data reported by medical record staff, the growth in third-party reimbursement for many services, provided inside and outside of hospitals, suggests the demand for medical record professionals will also grow. A related issue is the increasing number of sophisticated and/or complex reimbursement systems being introduced (e.g. DRG-based) which require that the medical record staff be able to exercise substantial judgment to ensure that maximum levels of reimbursement are achieved.

Another factor affecting demand for medical record services is the increased awareness, in recent years, of the necessity of being able to demonstrate accountability for actions taken in patient care. One interviewee said this underlies the shift, in recent years, toward evaluation of patient records and development of the problem-oriented medical record approach. The malpractice environment, patient education, and consumerism have forced physicians to become aware of the necessity of accurate and complete records, this participant stated.

Expansion of the role of the RRA within health care institutions is perceived as being demand-increasing by several interviewees. RRAs can provide extensive support services to other hospital departments such as admissions and X-ray. Trained medical record personnel are also becoming involved in quality assurance and risk management activities.

Finally, a more active role in marketing the profession by AMRA was suggested as a method to increase demand. Although 80 percent of active RRAs are currently in hospital settings, services could be marketed to other institutions and organizations providing ambulatory care and to industrial record management departments.

Other Considerations. Several interviewees mentioned that a maldistribution of medical record professionals exists. One interviewee suggested that this maldistribution is related to the distribution of educational programs. In 12 states, there are no educational programs for RRAs or ARTs. She said that the AMRA-sponsored correspondence course is especially beneficial in that it offers opportunities for students in rural areas to become trained even though no programs are available in a state or area.

Another factor mentioned by several interviewees is that there is an expectation that the distribution of medical record professionals among employment settings will change in the future. The increasing emphasis on hospital cost containment may lead to a reduction in hospital inpatient care which could mean a decline in the demand for medical record personnel in hospitals. However, the growth in ambulatory care settings and alternative health care delivery settings may require more medical record personnel in these areas.

Summary: An overview of the major findings which have emerged from these interviews with nine medical record professionals is presented in Table 11.6.

There are two major unresolved areas which have substantial implications for estimation of requirements for medical record professionals.

1) There is a need for clear delineation of the roles of RRAs and ARTs and specification of the types of settings in which ARTs can function independently of RRA supervision. This information will enable estimate of separate requirements functions for each occupation.

2) Of greater importance, determination of and agreement on what groups constitute the medical record work force is essential. It is not possible to examine either current requirements or future requirements without specifying clearly whether the profession is to be defined as including (a) those individuals with an RRA or ART or (b) all persons who work in a medical record department in (essentially) any capacity. Resolution of this issue is critically important prior to the development of recommendations for estimation of requirements for medical record professionals.

There are numerous factors other than those presented in Table 11.6 which may be expected to affect requirements for medical record personnel. These are discussed in the following sections which present a full discussion of each occupation in this cluster.

Table 11.6: SUMMARY OF MAJOR FINDINGS FROM INTERVIEWS WITH MEDICAL RECORD PROFESSIONALS

ISSUE	FINDINGS
Overview	o There does not seem to be a strong perception that there is a current shortage of RRAs and/or ARTs.
	o Considerable concern exists about current estimates of the supply of medical record personnel which appear to include substantial numbers of untrained personnel.
Need Factors	o Increasing need for medical services creates need for medical record professionals.
	o Computerization of records and other technological changes increase the need for medical record professionals.
Demand Factors	o Legislation and regulations may be demand-increasing or demand-reducing. Many existing regulations (e.g., PSRO, patient access to records), however, are expected to increase demand.
	o Increasing levels and complexity of third-party reimbursement for services require quality data and professional judgment.
	o The awareness of the importance of good data has increased as a result of malpractice experience and similar phenomena.
	o Expansion of the role of medical record professionals and increased awareness of the value of trained personnel, due to marketing activities, will increase demand.

Table 11.6: (continued)

ISSUE	FINDINGS
Other Factors	o Maldistribution of medical record professionals exists. o There may be future shifts in the distribution of medical record professionals among employment settings.

Recommendations for Estimating Requirements for Medical Record Personnel

Medical Record Administrators

The review of data sources on the supply of medical record administrators leads to the following conclusions:

(1) there appear to be adequate and appropriate data available on the supply of RRAs in all employment settings;

(2) there are no appropriate data sources on the total supply of registered and nonregistered record administrators in all employment settings; and

(3) there are comparable estimates of the total supply of registered and nonregistered medical record administrators in hospital settings only but not in other settings.

Estimating Current Requirements for Medical Records Administrators: The general recommendation proposed in Chapter 2 of this report is that a personnel-to-population ratio approach be used to develop current requirements estimates. Definitional considerations and data constraints make implementation of this recommendation somewhat problematic for medical record administrators. Consequently, the following specific recommendations for estimation of current requirements are provided:

Recommendation 1(a): If the definition of the population selected includes only Registered Record Administrators, then state-level RRA-to-population ratios should be calculated using data from AMRA for the numerator of the ratio.

Recommendation 1(b): If the selected definition of medical record administrator includes the total supply of registered and nonregistered personnel, construction of a total personnel-to-population ratio is not recommended. Instead, it is recommended that an estimate of total requirements for medical record administrators in hospitals only be constructed (i.e., a medical record administrator-to-hospital bed ratio) using data from NCHS-SHS and from AHA. Although this approach will only produce a partial estimate of requirements for medical record administrators, it will provide useful information for assessment and planning based upon the limited existing data. A similar estimate for nursing home requirements might also be constructed using data from NCHS-NNHS for the numerator and data from the Area Resource File or other sources on nursing home beds for the denominator. However, it should be recognized that no comparable data to the NCHS-NNHS survey are available to permit assessment of the quality of these data.

Recommendation 2: Determination of a standard of adequacy for the ratio should be made. A national mean or a state median value may be appropriate. Since use of a national average would incorporate existing shortages, if present, into the requirements estimate, it is recommended that determination of the standard of adequacy take into account any existing evidence on the presence of a current shortage (e.g., number of job vacancies, rate of increase in salary levels).

Recommendation 3: Use of the calculated requirements ratio standard of adequacy to assess whether subnational geographic regions have sufficient medical record administration to meet existing requirements should take into account characteristics of the subnational region in determining whether an excess or shortage of medical record administrators exists. Specifically, consideration should be given to the presence of employment settings in which medical record administrators may be employed (e.g., hospitals, nursing homes) and the regional supply of medical record technicians. This latter consideration should be evaluated carefully since there is overlap in the functional areas of performance of these two professions.

Estimating Future Requirements for Medical Record Administrators: The medical record administrator-to-population ratio and/or the hospital medical record administrator-to-hospital bed ratio and the standard of adequacy selected to estimate current requirements for medical record administrators will provide the basis for estimation of future requirements for medical record administrators.

One alternative approach to estimating future requirements is to assume that the standard of adequacy represents the minimum level of future requirements. Therefore, projected increases in the population require that proportional increases in the numerator of the ratio occur. This approach has the advantage of simplicity but fails to take into account factors other than population growth which may be expected to affect requirements for medical record administrators in the future.

Interviews with individuals knowledgeable of the medical record field focused, to a great extent, on factors which are expected to affect requirements for medical record services in the future. A summary of the more relevant of the findings from these interviews has been provided in Table 11.6. Review of this information has resulted in the development of the following recommendations for determining future requirements for medical administrators:

Recommendation 4: The standard of adequacy of the ratio selected for the estimation of current requirements for medical record administrators should be used as the foundation for the development of estimates of future requirements. Projections of future population size from the U.S. Bureau of the Census can be used to establish the denominator of the future ratio and the numerator (i.e., required number of medical record administrators to provide a constant level of services to the future population) can then be constructed. Calculation of future requirements for hospital medical record administrators is somewhat more difficult. Projections of future growth of hospitals and bed capacity will require solicitation of informed or expert opinion.

Recommendation 5: Refinement of the estimate of future requirements should take into account the factors indicated in Table 11.6, to the extent possible. While the direction of the effects of such factors on requirements may be clear, the magnitude of the impacts have not been determined. Consequently, it is recommended that professional opinions be sought prior to attempting to refine the ratio to permit adjusted future requirements to be calculated.

Recommendation 6: It is recommended that projections of future requirements for medical record administrators be prepared in coordination with similar projections for medical record technicians. This is essential since these two professions may be substitutes in some employment settings.

As has been discussed previously, the reliability of future estimates of requirements for medical record administrators declines the further into the future for which the projections are developed. The use of professional judgment and expert opinion is particularly critical for projections of future requirements.

Medical Record Technicians

Estimating Current Requirements for Medical Record Technicians: The first necessity for production of reliable estimates of requirements for this occupation is a standardized definition of the occupation.

Although the American Medical Record Association provides data on ARTs, no independent comparable estimate is available which validates the AMRA data counts. In addition, no data source was found which could be used as a reliable source of data on the supply of medical record technicians. Although some sources are available, the reliability of these estimates cannot be assessed and the estimates exhibit a large range of values. In sum, there is no continuing, reliable source of data on either the total supply of medical record technicians or the distribution of technicians by employment setting. Consequently, the following specific recommendations for estimation of requirements for medical record technicians are suggested:

Recommendation 1(a): If a definition of medical record technician is selected which restricts the profession to include only ARTs, then it is recommended that AMRA data be used to construct an ART-to-population ratio for use in assessing requirements for medical record technicians.

Recommendation 1(b): If a definition of medical record technicians is adopted which includes certified and noncertified personnel, then it will be necessary to choose the data to construct a medical record technician-to-population ratio. No reliable data are currently available on the total supply of certified and noncertified personnel. Consequently, the choice of this definitional alternative implies that only very rough approximations of requirements for medical record technicians can be calculated using a personnel-to-population ratio.

Recommendation 2(a): If an ART definition is selected, then state-level-to-population ratios should be calculated using AMRA data. A standard of adequacy can be determined on the basis of a national mean, state-level median, or professional opinion. As was suggested for RRAs, consideration should be given to the presence of existing conditions which may signify a shortage of ARTs when determining the standard of adequacy.

Recommendation 2(b): If both certified and noncertified persons are to be included in the professional definition, then it is recommended that a national mean medical record technician-to-population ratio be used as the standard of adequacy. The existing data are uncertain as to reliability and refinement of the national average would be correspondingly uncertain as to reliability.

Recommendation 3: To the extent that the determined standard of adequacy of the ratio is to be used to assess adequacy of medical record technician supply at a subnational geographic regional level, consideration should be given to specific conditions in the subnational area which may affect requirements. Of particular concern should be such factors as the apparent adequacy of the supply of medical record administrators and the number and size of potential employment settings. Informed opinion may provide useful input to assessments of this type.

Overall, it should be recognized that estimating requirements for total medical record technicians will be an imprecise exercise at best. Thus, these estimates, if developed, should be utilized only with great caution.

Estimating Future Requirements For Medical Record Technicians: The choice of a standard of adequacy for the current medical record technician-to-population ratio can provide a basis for estimation of future requirements for medical record technicians. As was discussed above, interviews with persons knowledgeable of the field of medical records have produced information on factors which should be taken into account in estimating future requirements for this profession (Table 11.6). Thus, the following specific recommendations are offered for estimation of future requirements for medical record technicians:

Recommendation 1: The standard of adequacy of the medical record technician-to-population ratio selected for the estimation of current requirements should be used as the basis for development of estimates of future requirements. Projections of future population size from the U.S. Bureau of the Census can be used to establish the denominator of the future ratio and the numerator (i.e., the required number of medical record technicians to provide a constant level of services to the future population) can then be constructed.

Recommendation 2: Estimation of future requirements for medical record technicians should be closely coordinated with estimation of future requirements for medical record administrators. Since the factors cited in Table 11.6 affect requirements for medical record services provided by both professions, similar assumptions and methodologies should be used for both calculations. Professional opinion should be sought on the issues of complementarity and substitutability between the two professions, in addition to those factors discussed for the medical record administrator estimates.

It must be stressed that estimates of future requirements for medical record technicians should be viewed as of low reliability for planning or other purposes. The uncertain quality of current data available suggests that projections into the future may not incorporate sufficient knowledge of this market to produce reliable results. Consequently, short-term estimates of future requirements may be of some potential usefulness but long-term projections may be expected to be of low probability of accuracy.

Personnel-to-Population Ratios

Careful review of the findings of this study led to a recommendation that the personnel-to-population ratio be used as an initial departure point for estimation of requirements for allied health occupations. Review of data sources and reliability resulted in a conclusion that only estimates for credentialed medical record personnel are feasible at this time. These estimates are presented in Tables 11.7, 11.8, and 11.9.

It is emphasized that these ratios are based on estimates of the supply of credentialed personnel, only. There may be, as has been discussed above, a substantial number of non-credentialed individuals providing medical record services. No reliable data are available to permit calculation of personnel-to-population ratios which include this group.

Table 11.7: NATIONAL PERSONNEL-TO-100,000 POPULATION RATIOS, MEDICAL RECORD PERSONNEL, 1978

OCCUPATION	TOTAL SUPPLY, 1978	PERSONNEL-TO 100,000-POPULATION
Registered Medical Record Administrators	6,500	3.0
Accredited Record Technicians	12,500	5.8

SOURCES: (1) American Medical Record Association Membership Files, 1978
(2) U.S. Bureau of the Census

Table 11.8: REGISTERED RECORD ADMINISTRATOR-to-100,000 POPULATION, by STATE, APRIL 1981

State	Number of Registered Record Administrators	Personnel-to-100,000 Population
Alabama	118	3.03
Alaska	15	3.74
Arizona	73	3.19
Arkansas	97	3.56
California	749	3.16
Colorado	129	4.46
Connecticut	82	2.63
Delaware	12	2.01
District of Columbia	110	17.25
Florida	371	3.08
Georgia	210	3.84
Hawaii	31	3.21
Idaho	22	2.33
Illinois	545	4.77
Indiana	182	3.31
Iowa	96	3.29
Kansas	113	4.78
Kentucky	90	2.45
Louisiana	267	6.35
Maine	30	2.66
Maryland	115	2.72
Massachusetts	248	4.32
Michigan	296	3.19
Minnesota	278	6.81
Mississippi	111	4.04
Missouri	251	5.01
Montana	60	7.59
Nebraska	124	7.89

Table 11.8: (Cont.)

State	Number of Registered Record Administrators	Personnel-to-100,000 Population
Nevada	15	1.87
New Hampshire	19	2.06
New Jersey	132	1.79
New Mexico	47	3.61
New York	498	2.72
North Carolina	237	4.03
North Dakota	30	4.59
Ohio	243	2.25
Oklahoma	155	5.12
Oregon	106	4.02
Pennsylvania	415	3.49
Rhode Island	17	1.79
South Carolina	90	2.88
South Dakota	33	4.78
Tennessee	198	4.31
Texas	642	4.51
Utah	23	1.57
Vermont	14	2.73
Virginia	117	2.18
Washington	256	6.19
West Virginia	41	2.01
Wisconsin	273	5.08
Wyoming	13	2.76

SOURCES: (1) American Medical Record Association Membership Files, April, 1981.

(2) U.S. Bureau of the Census.

Table 11.9: ACCREDITED RECORD TECHNICIANS-TO-100,000 POPULATION BY STATE, APRIL 1981

State	Number of Accredited Record Technicians	Personnel-to-100,000 Population
Alabama	390	10.02
Alaska	41	10.23
Arizona	302	11.11
Arkansas	174	7.61
California	1981	8.36
Colorado	375	12.98
Connecticut	129	4.15
Delaware	24	4.03
District of Columbia	165	25.87
Florida	677	6.95
Georgia	344	6.29
Hawaii	54	5.59
Idaho	152	16.1
Illinois	852	7.46
Indiana	310	5.64
Iowa	307	10.53
Kansas	388	16.41
Kentucky	352	9.61
Louisiana	210	4.99
Maine	99	8.08
Maryland	219	5.19
Massachusetts	435	7.58
Michigan	850	9.18
Minnesota	463	11.35
Mississippi	190	7.53
Missouri	502	10.02
Montana	89	11.31
Nebraska	168	10.07

Table 11.9: (Cont.)

State	Number of Accredited Record Technicians	Personnel-to-100,000 Population
Nevada	76	9.05
New Hampshire	80	8.68
New Jersey	271	3.67
New Mexico	109	8.38
New York	1111	6.32
North Carolina	395	6.72
North Dakota	97	14.86
Ohio	834	7.72
Oklahoma	272	8.99
Oregon	377	14.32
Pennsylvania	695	5.85
Rhode Island	51	5.38
South Carolina	175	5.61
South Dakota	91	13.18
Tennessee	432	9.41
Texas	1105	7.76
Utah	65	4.44
Vermont	36	7.03
Virginia	320	5.98
Washington	597	14.45
West Virginia	159	8.15
Wisconsin	477	10.13
Wyoming	55	11.68

SOURCES: (1) American Medical Record Association Membership Files, April, 1981.

(2) U.S. Bureau of the Census.